

metal finishing

PAINT APPLICATION, ELECTRODEPOSITION, VITREOUS ENAMELLING,
CATANIZING, METAL SPRAYING and all METAL FINISHING PROCESSES

Vol. 5 No. 52 (New Series)

APRIL, 1959



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Today

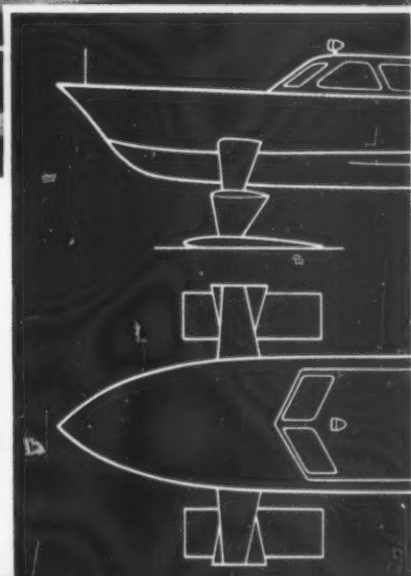


Tomorrow

Today the Gas Industry offers excellent plant for the finishing industries,—while research on immersion tube heating and more economical radiant panels and stoving ovens will help to keep tomorrow's finishing costs low . . . **AND TODAY—** every industry and 12 million homes use GAS.



ISSUED BY THE GAS COUNCIL



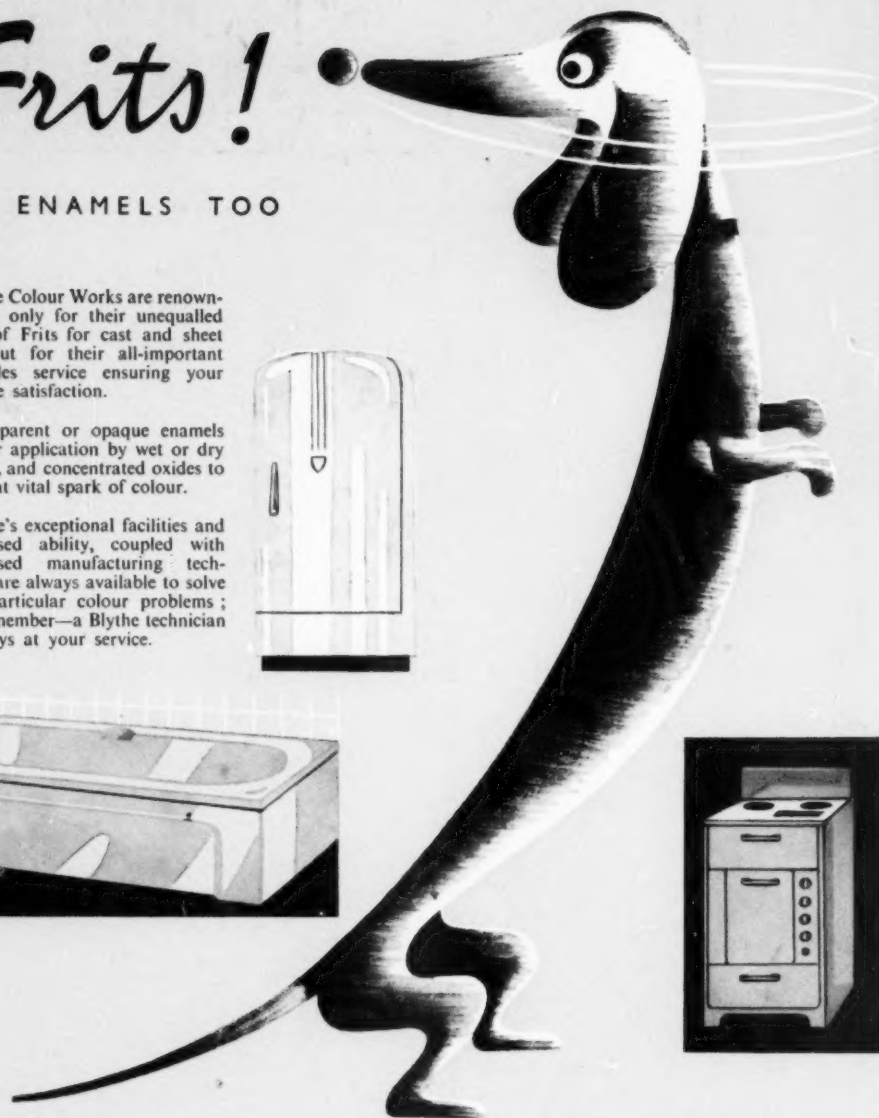
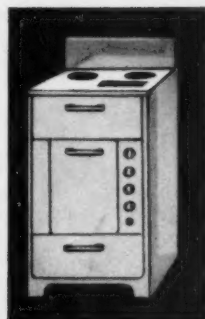
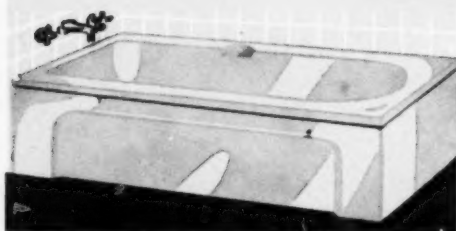
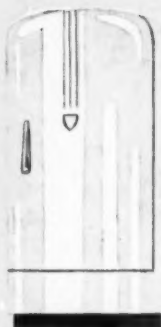
Frits!

AND ENAMELS TOO

Blythe Colour Works are renowned, not only for their unequalled range of Frits for cast and sheet iron, but for their all-important after-sales service ensuring your absolute satisfaction.

Transparent or opaque enamels too, for application by wet or dry process, and concentrated oxides to give that vital spark of colour.

Blythe's exceptional facilities and recognised ability, coupled with specialised manufacturing technique, are always available to solve your particular colour problems; and remember—a Blythe technician is always at your service.



BLYTHE COLOUR WORKS LTD.
CRESSWELL • STOKE-ON-TRENT • ENGLAND
Telephone BLYTHE BRIDGE 2101

Blythe

home of the world's best colours

Mr. Morris Isaac with an Atlas Copco Ecco 30 type spray gun beside a newly painted Massey-Harris-Ferguson tractor.



The Ecco 30 spray gun. The thumb tab next to the trigger spreads or narrows the fan of the paint spray at a touch.

Massey-Harris-Ferguson painter says:

'Finest spray gun I've ever used'

CANADIAN FARM MACHINERY at the Massey-Harris Ferguson plant in Woodstock Ontario is painted *entirely* by spray gun nowadays—the Atlas Copco Ecco 30. Since the Ecco 30 was introduced they no longer need to touch up hard-to-get-at places by hand. Today, a painter with an Ecco 30 can do the whole job far faster simply by narrowing or widening the fan of the paint spray as he works. Recently, on a government contract, Massey-Harris-Ferguson has used the Ecco 30 eight hours a day—and they found that the lightweight gun was faster than dip-painting. They also use the Ecco 30 on

spare parts. The Ecco is light—the lightest in its class. It's built to last with tougher materials for the harder-worked parts. There are combinations of air cap and nozzle for any spray fluid. You'll find the Atlas Copco Ecco 30 the finest spray gun *you've* ever used.

A COMPLETE RANGE OF COMPRESSED AIR EQUIPMENT

Atlas Copco manufacture portable and stationary compressors, rock-drilling equipment, loaders, pneumatic tools and paint-spraying equipment. These are sold and serviced by companies or agents in ninety countries throughout the world.

Atlas Copco PUTS COMPRESSED AIR TO WORK FOR THE WORLD

Contact your local company or agent or write to
Atlas Copco AB, Stockholm 1, Sweden, or Atlas Copco (Great Britain) Limited, Beresford Avenue, Wembley, Middlesex.



change now ... to



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and price list of
Metalworking coated
abrasive materials to:*

Name.....

Company.....

Address.....

C4

One minute of your precious time—that's all it will take to fill in the coupon below.

It will introduce you to valuable time savings in production and finishing methods from the use of E.A.C. 'shaped-grain' flexible abrasives. These coated abrasives, made by the latest controlled automation techniques, incorporate every worthwhile advance in design and manufacture. In the wide range of E.A.C. belts, discs, sheets and special shapes there is sure to be, for any operation, one that cuts faster and wears longer than those you are now using.

The right abrasive can save you money, let us find it for you; send now for samples, specifications, prices of the best abrasive for any operation in your industry.

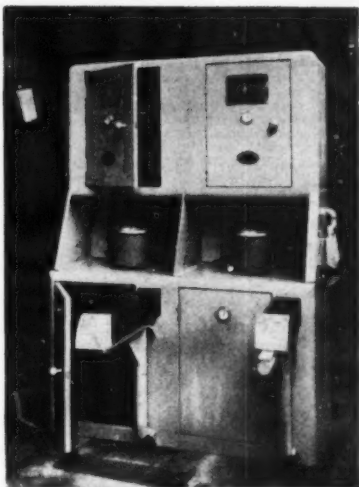
coated abrasives

ENGLISH ABRASIVES CORPORATION LTD

Marsh Lane, Tottenham, London N.17
Tel: Tottenham 5057

SUBSIDIARIES:

Thos. Goldsworthy & Sons Ltd
The Helvetia Abrasives Co Ltd
London Abrasives Ltd



MOP DRESSING CABINETS

Normally the equipment required to coat with abrasive grit different kinds of mops consists of separate units, i.e., emery troughs, glue-pots and heaters, curing and drying cabinets, etc., but with these mop dressing cabinets all necessary requirements are contained in one compact assembly.

Heating can be effected either by steam or electricity, and thermostatically controlled in curing, drying and glue-pot sections. This is an essential item where super finishes are required.

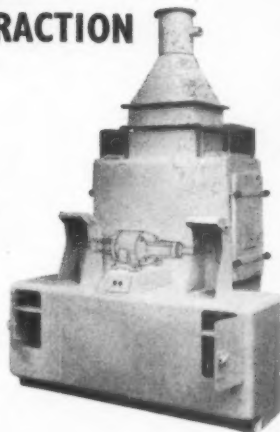
WET SCRUB DUST EXTRACTION UNIT

During the past few years there has been a considerable increase in the applic-

ation of wet scrubbing of gases containing solid particles particularly to magnesium alloys and other metals which have an explosive contingency when broken down into particles.

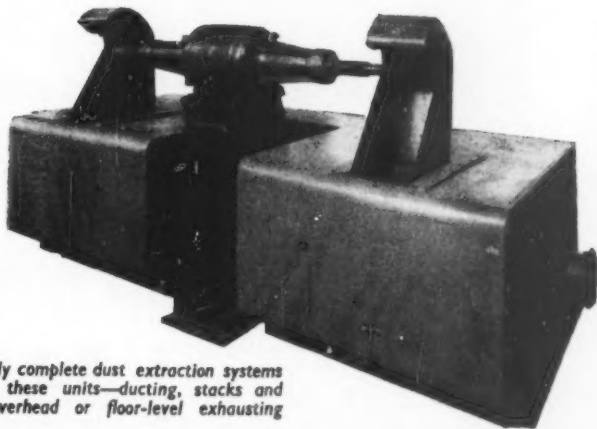
The unit illustrated has been applied to a normal double-ended polishing or grinding spindle and its neat, clean appearance and compact arrangements are obvious.

Where dangerous dusts are collected a comprehensive range of automatic safety control gear is incorporated which complies with the Factory Act.



POLISHING BENCHES

These are ideal polishing Benches for small or medium sized components. Note the strong hoods, with ample adjustment provided; the absence of ledges and sharp corners; flush doors to operator's cupboards, and a large clear area for component storage.



We also supply complete dust extraction systems suitable for these units—ducting, stacks and filters—for overhead or floor-level exhausting installations.

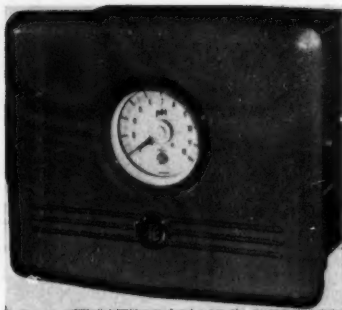
A. E. GRIFFITHS (SMETHWICK) LTD., BOOTH STREET, BIRMINGHAM 21

**PORTABLE pH METER CAT. NO. 11071**

The new Pye Portable pH Meter is completely self-contained, with batteries, direct-reading meter and accessories. The front of the right hand compartment drops down to provide an electrode stand. The sheathed electrode assembly, however, can be carried in the hand when it is required to take on the spot dip tests.

A four valve amplifier with a large degree of negative feedback enables a robust meter movement to be used and provides exceptional linearity and stability of calibration. The input stage uses an electrometer type of valve which reduces errors due to grid current and input conductance to a very low order. All valves are robust sub-miniature types giving maximum immunity from mechanical shock and very low power consumption. Consumption is balanced between batteries to equalise battery life and to ensure that the very low battery drain is used to the greatest advantage.

The instrument is contained in a resin-sealed hardwood case, which has been specially treated against acids and other corrosives.

**INDUSTRIAL pH AMPLIFIER 'H' Cat. No. 11530**

The Pye Industrial pH Amplifier has been designed to operate under the widest range of factory conditions and provides a robust, reliable and accurate means of achieving higher productivity, better quality of products and considerable saving in labour and plant maintenance costs.

The instrument is essentially a voltage amplifier with a high internal gain and a large amount of negative feedback: there is exceptional linearity of response and the sensitivity is unaffected by mains variations or valve changes. The sensitivity is high (100 microamps/pH) and therefore external recorders, indicators, controllers and alarm systems can be operated from the same amplifier and may if necessary be mounted some distance away. Complete automatic temperature compensation is provided over the range 0–100°C. There is exceptional zero stability.

The pH Amplifier is supplied in a flush mounting, moisture and fume-proof case. A flameproof model (Cat. No. 11540) is also available.

The panel meter has an 8-inch scale length and is calibrated 2–12pH or to the range specified by the customer.

The pH Amplifier is designed to operate with Pye electrode assemblies, either the Immersion Type or the Continuous Flow Type. They are adaptable to virtually all types of processes and are robust, reliable and easy to maintain.

SCIENTIFIC  INSTRUMENTS

Please write for our new leaflets.

W. G. PYE & CO. LTD.

GRANTA WORKS, NEWMARKET ROAD,

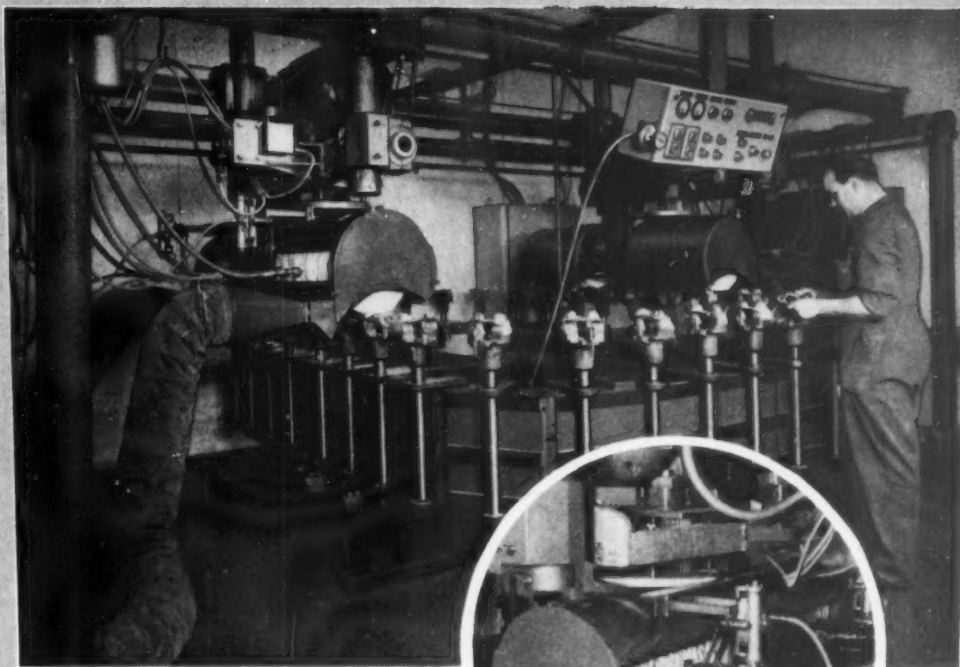
CAMBRIDGE. Tel: CAMBRIDGE 54411

Grams: PYE, CAMBRIDGE



UNIFLEX

MACHINES *



**A NEW
TECHNIQUE OF**

Automatic **POLISHING**

Uniflex Machines, using Airflow Mops and Liquid composition, are the answer to the problem of economical mass-production polishing.

FLEXIBLE — Can be enlarged or reduced to meet changing production demands.

VERSATILE — Readily adaptable to different shaped components and an extensive range of metals and finishes.

Please write for particulars.



BIRMINGHAM 18. Telephone: CEN. 8621 LONDON & SHEFFIELD

More wear resisting than Tungsten Carbide



FODENS
ELWORTH WORKS

Fodens
LIMITED
SANDBACH CHESHIRE

2nd May, 1957

ADPT/CAM.
EJP/PB/LAB.

Messrs. Glostics Ltd.,
Tuffley Crescent,
Gloucester.

For the attention of Mr. A.D.P. Tallents.

Dear Sirs,

In January 1955 you supplied us with two shot blast nozzles in Carbon Tetra Boride. These were immediately put into use in the shot blast cabinets in our Heat Treatment department, working at an air pressure of 40 to 60 lbs/sq. in., and using 30 mesh angular chilled cast iron grit as the abrasive.

It is estimated that each nozzle has now been in service for more than 5,000 hours, and recent dimensional checks show the amount of wear to be almost negligible. We are advised by you that the original nozzle bore diameter was $\frac{1}{8}$ " and it will be seen from the following figures that little, if any, wear has taken place.

| | |
|-------------------------------|------------------|
| Bore Size at Throat of Nozzle | .3745" to .3742" |
| Bore Size 1" from Throat | .3650" to .3648" |

We feel that an outstanding performance such as this should not go unnoticed, and you are therefore at liberty to use the information contained in this letter in any way you wish to further the publicising of C.T.B. nozzles.

Yours faithfully,
for FODENS LIMITED.

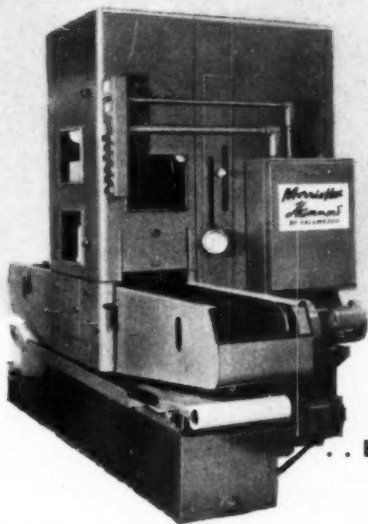
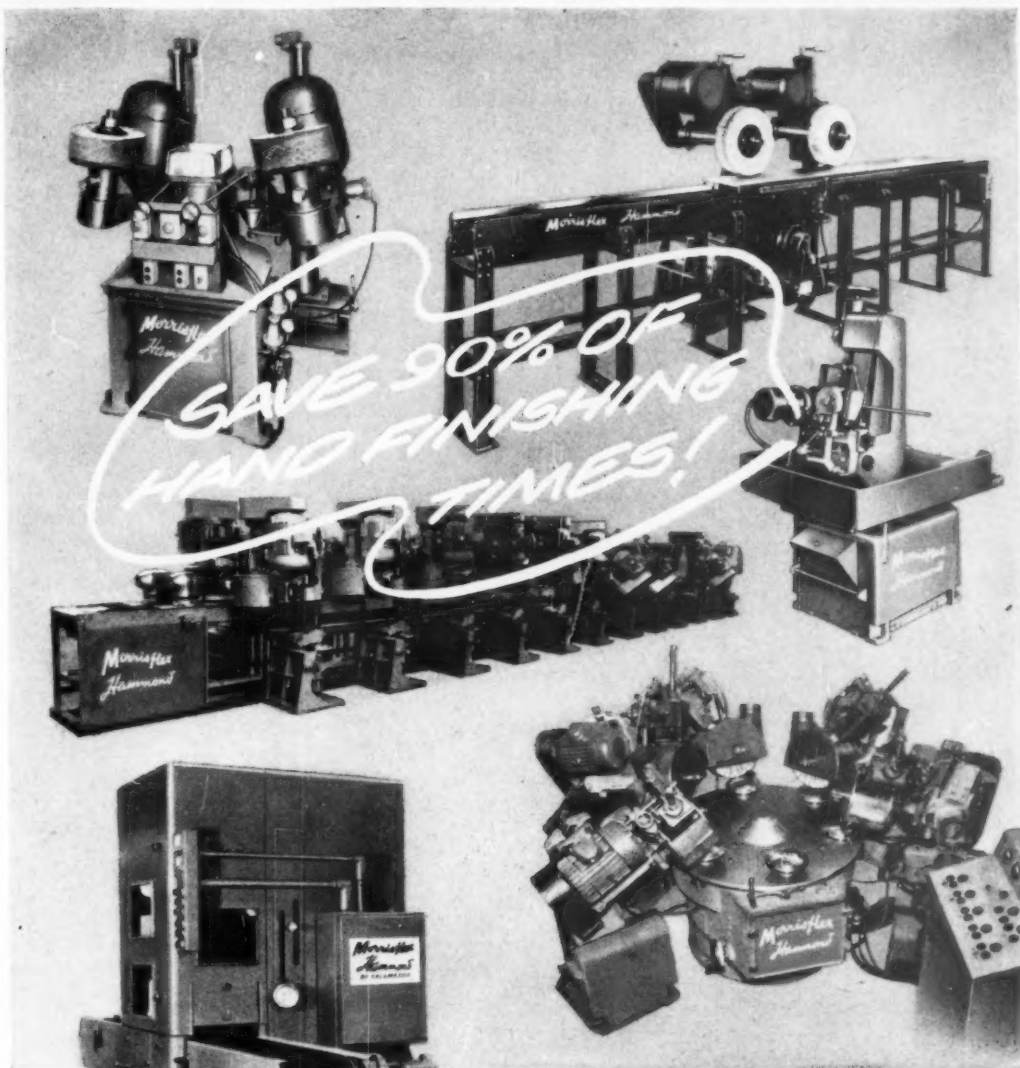
E.J. Phipps
E.J. PHIPPS,
CHIEF METALLURGIST.

C.T.B. SHOT BLAST NOZZLES

Glostics Ltd

(AGENTS) IMPREGNATED DIAMOND PRODUCTS LIMITED . TUFFLEY CRESCENT GLOUCESTER

WIN THE BATTLE OF THE BURR..



.. BY USING

Morrisflex

Hammons

BUILT UNDER LICENCE FROM
HAMMOND MACHINERY BUILDERS INC. U.S.A.

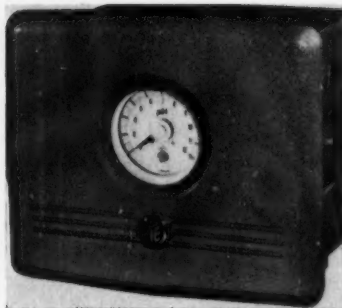
B. O. MORRIS LTD. • BRITON ROAD • COVENTRY
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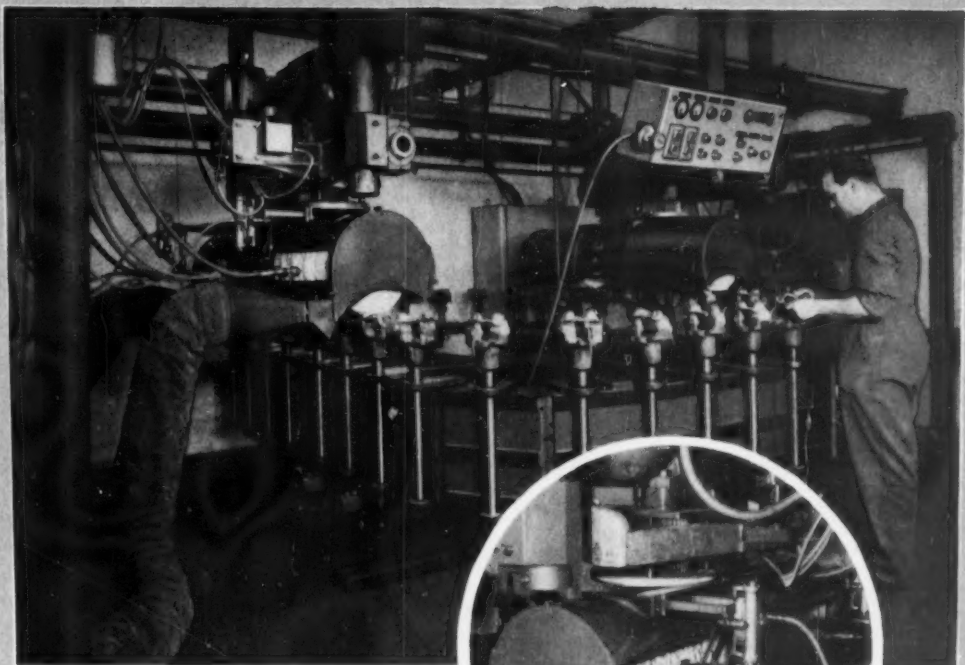
W. G. PYE & CO. LTD.

**GRANTA WORKS, NEWMARKET ROAD,
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E. J. Phipps

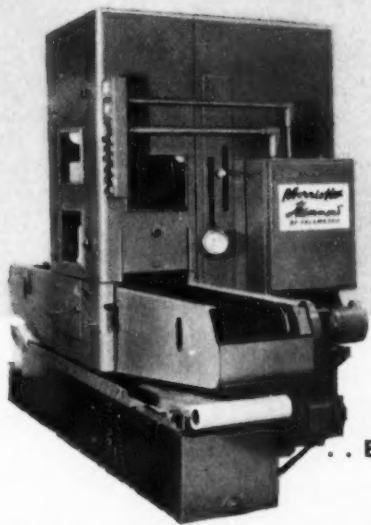
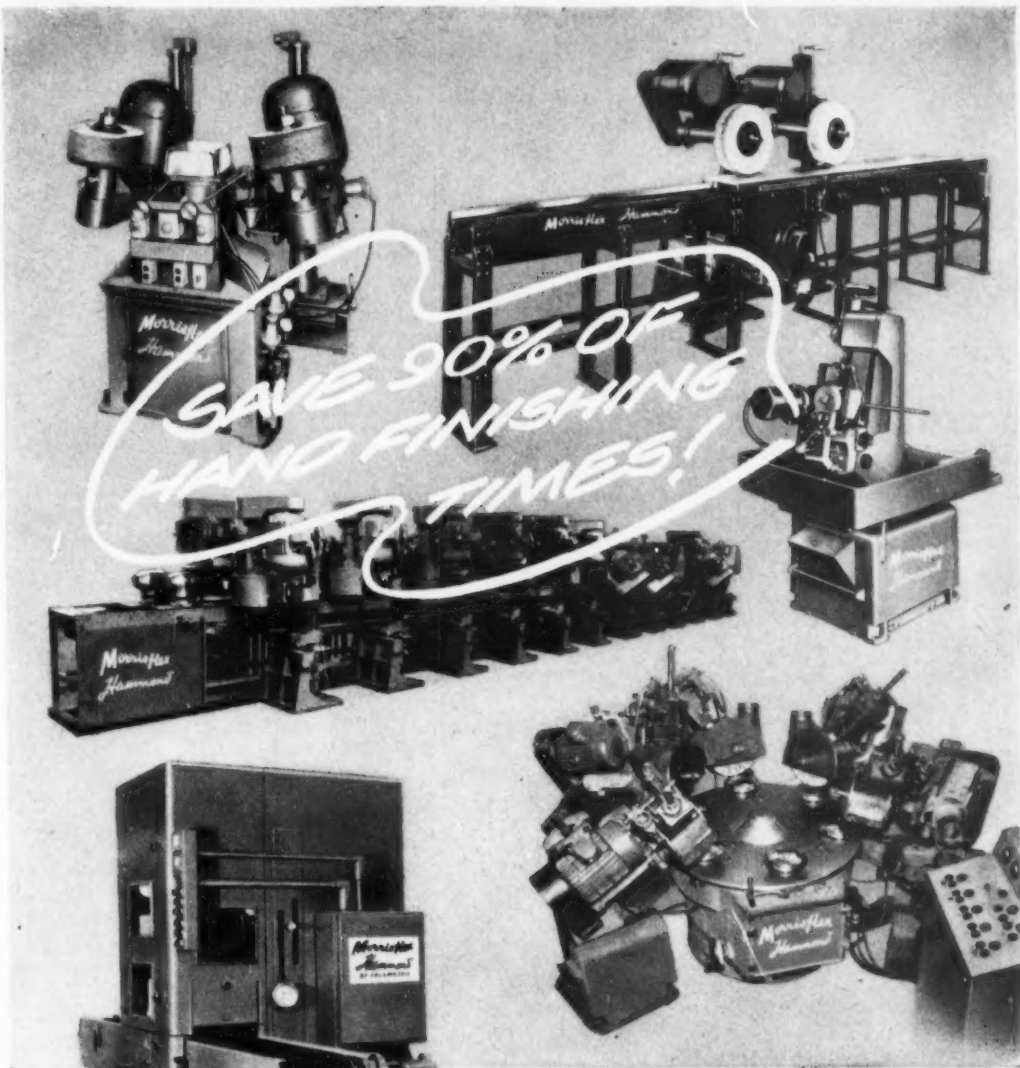
E. J. PHIPPS,
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Glostics Ltd

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WIN THE BATTLE OF THE BURR..



... BY USING

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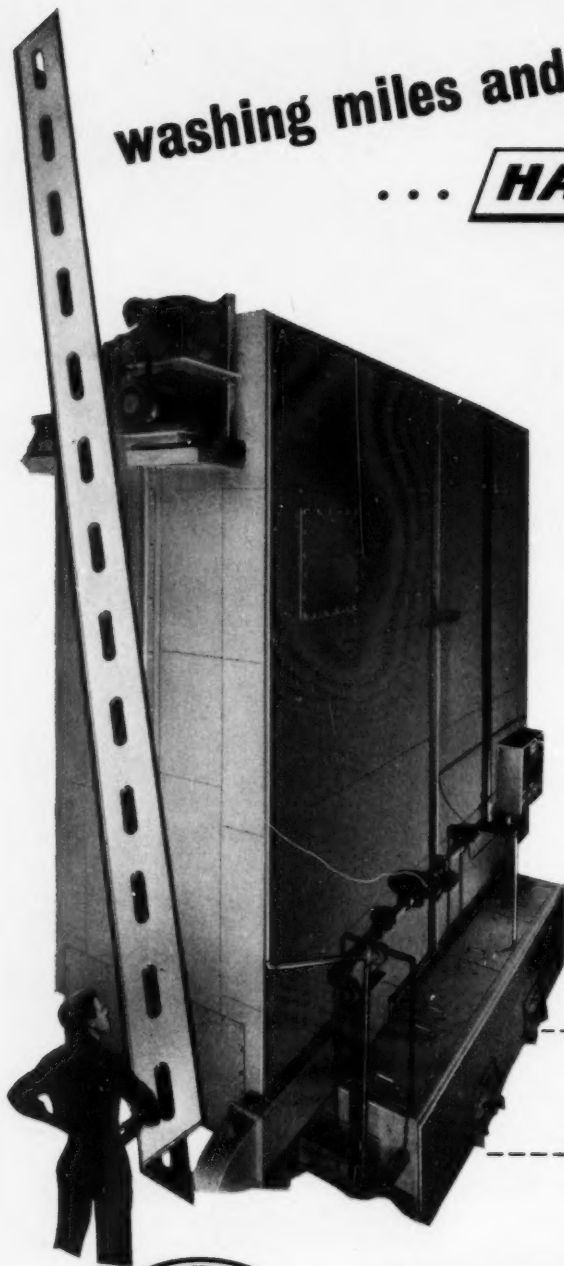
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For cleaning prior to electrostatic spray painting Handy Angle use EfcO Di-Phase processes and equipment exclusively.

EfcO Metal Cleaning Division supply plant for cleaning articles of any size, shape or quantity.

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SPECIALISTS IN METAL CLEANING

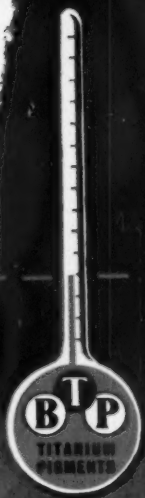
METAL CLEANING DIVISION

ELECTRO-CHEMICAL ENGINEERING CO. LTD.

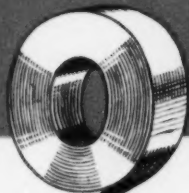
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ACID-RESISTANT ENAMELS
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They give opacity in a thin coat.



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It is formulated to fit the specific requirements of our customers being either ALKYDS, VYNOLS, EPOXIES, and other SYNTHETIC ENAMELS.

Material can be supplied in widths from 1"-16" and thickness from .004"-.040" using either our or the customer's materials.

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BAC/12A

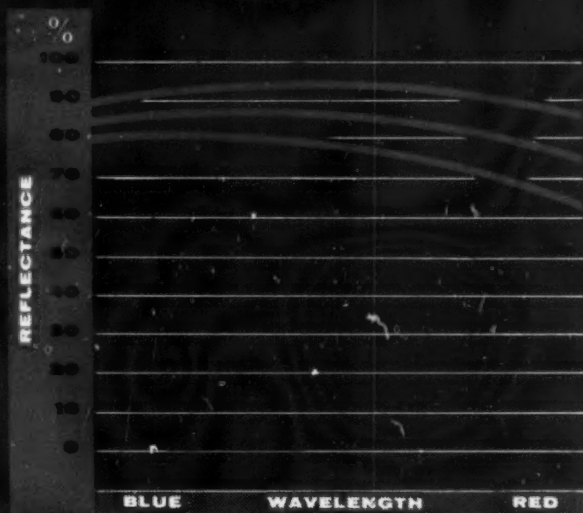


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Photograph by courtesy of
British Olivetti Ltd.



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Automatic Barrel plating unit

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and nickel plating.

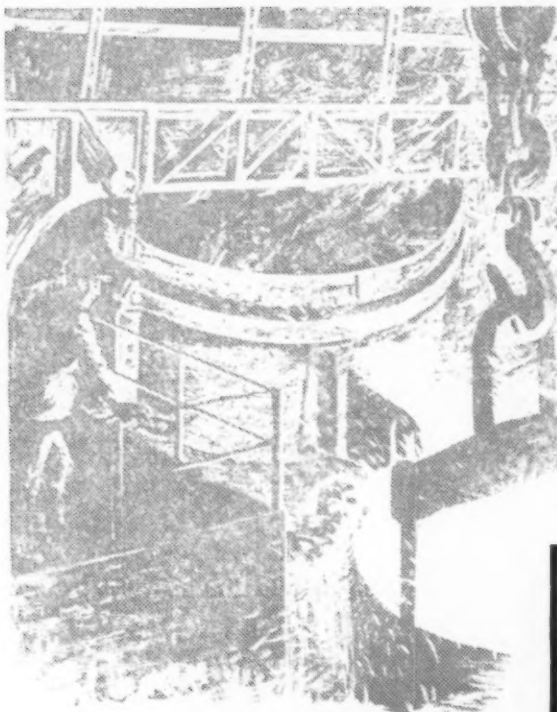
If you are interested in barrel plating
a . . . "SUBMATIC"

*is worthwhile looking
into straight away...*

Full details and advice from



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Hammered Finish

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EPILUX 2
Stoving Finish

Our Technical Advisory Service will gladly co-operate with you if your needs are not covered by our standard range and will, if necessary, formulate a Finish especially for you.



**BRITISH PAINTS
LIMITED**

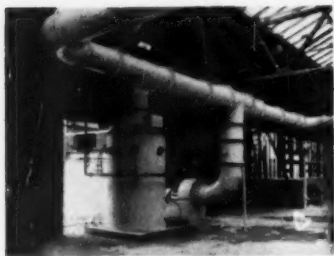
Portland Road, Newcastle upon Tyne, 2
Crewe House, Curzon St., London, W.1
31, Wapping, Liverpool

BELFAST, BIRMINGHAM, BRISTOL, CARDIFF, GLASGOW,
LEEDS, MANCHESTER, NORWICH, PLYMOUTH,
SHEFFIELD, SOUTHAMPTON, SWANSEA AND ALL
PRINCIPAL TOWNS.

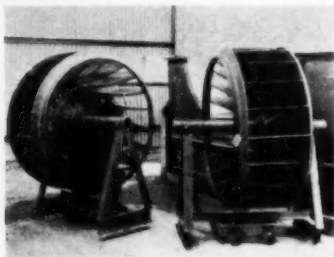
A FINE FINISH FOR EVERY PRODUCT

RUBBER LINED PLANT

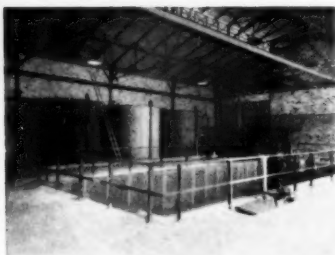
Supplied Direct to the Trade



FUME DUCTING AND SCRUBBER



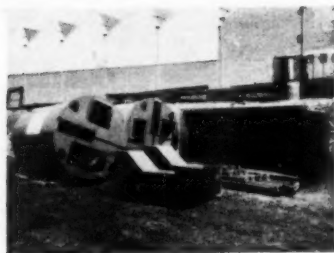
RUBBER COVERED FANS



SITE LINING

*A Lining to
Suit any
Problem—*

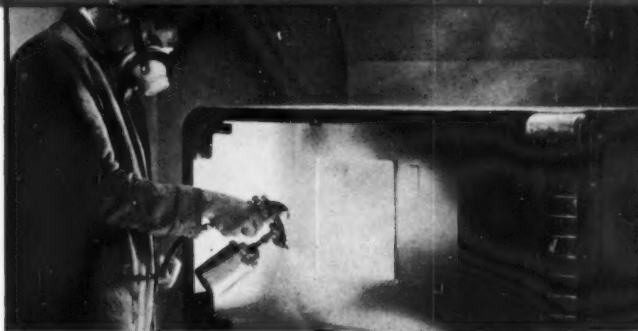
PROCESS TANKS



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MONFORT HOUSE · STOURBRIDGE · WORCS.

Telephone: Stourbridge 5131/2

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**OF PAINT OR
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Airless spraying shows 15% to
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- Better paint adhesion
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- Higher gloss finish
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- Healthier working conditions

Airless Spray picture - shows clear
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operator from rebound.

Spraying with Air picture - shows
heavy paint rebound and necessary com-
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products of Hoklykem.*

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SOLUTIONS FOR
BARREL PLATING**

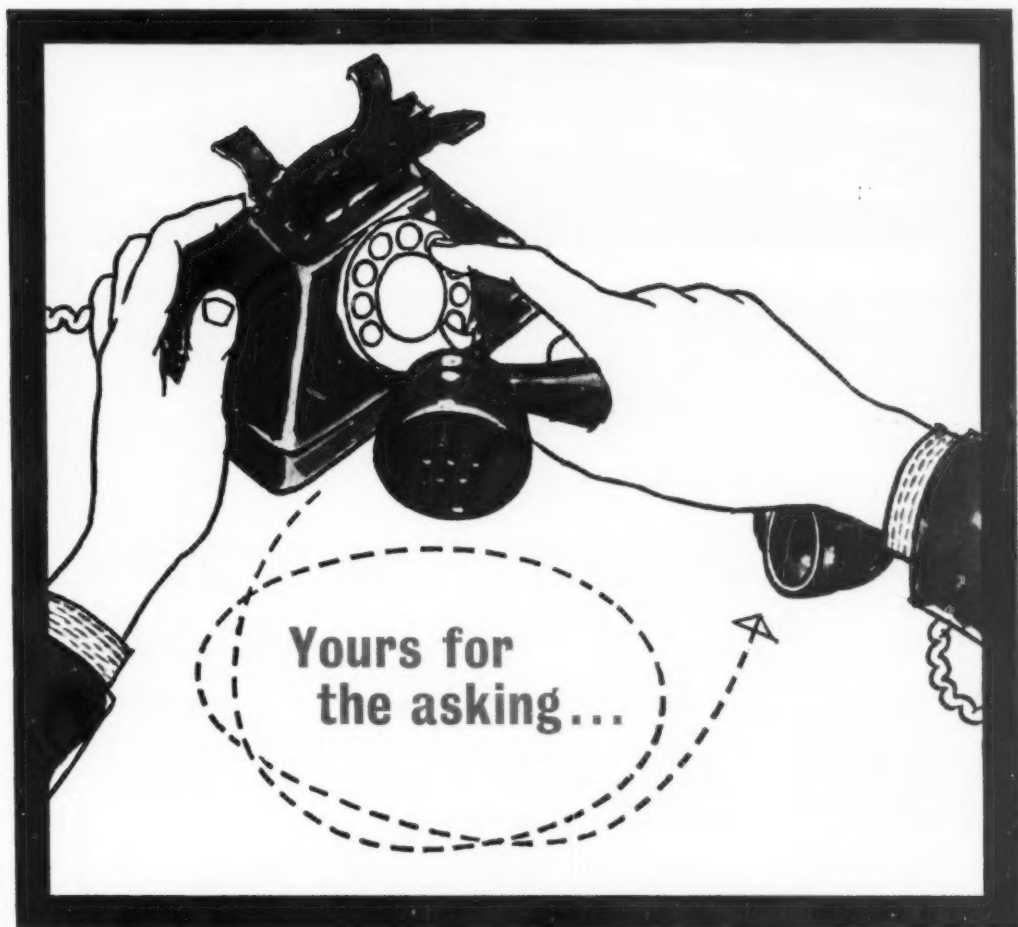
Electro Brass Salts
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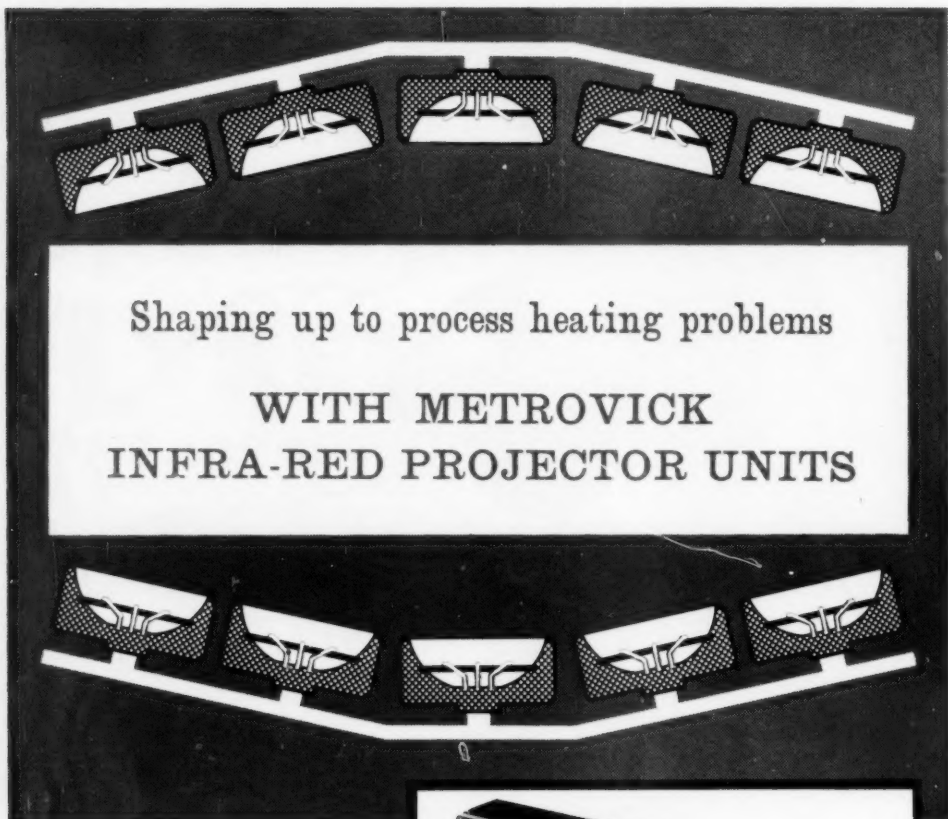
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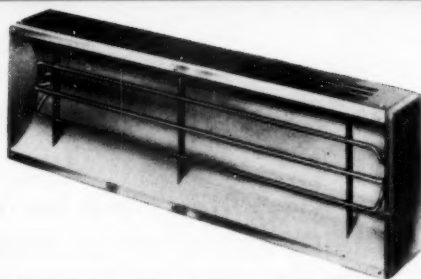


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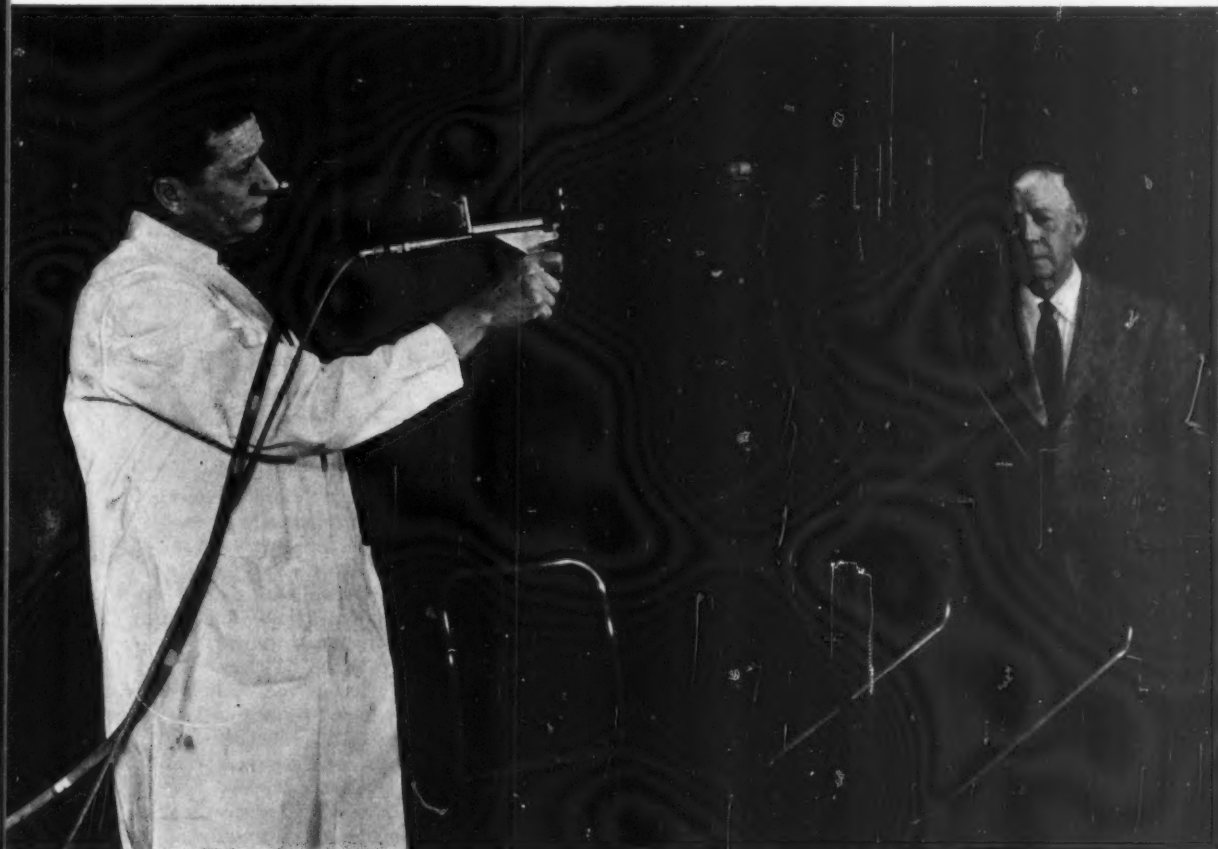
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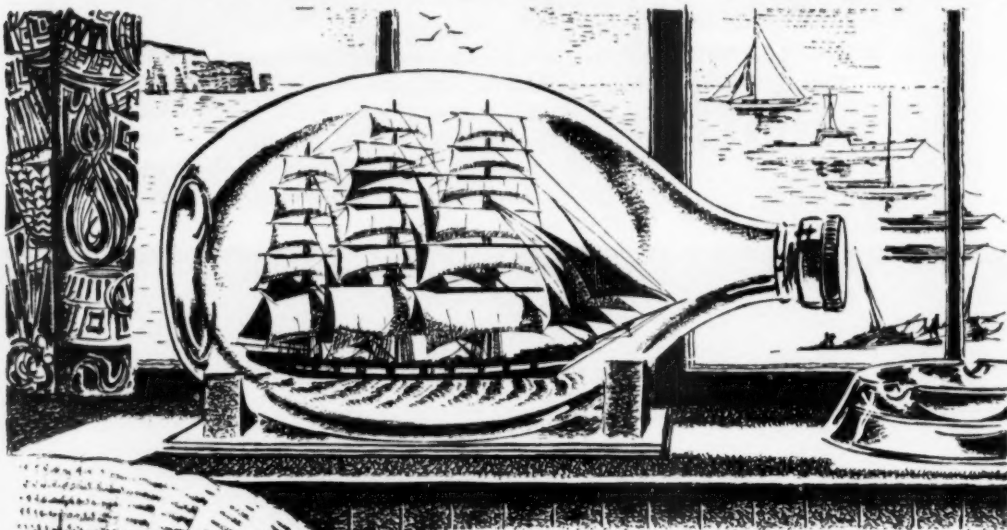
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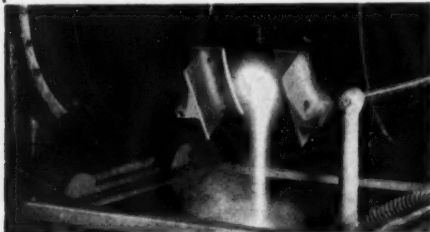
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April, 1959



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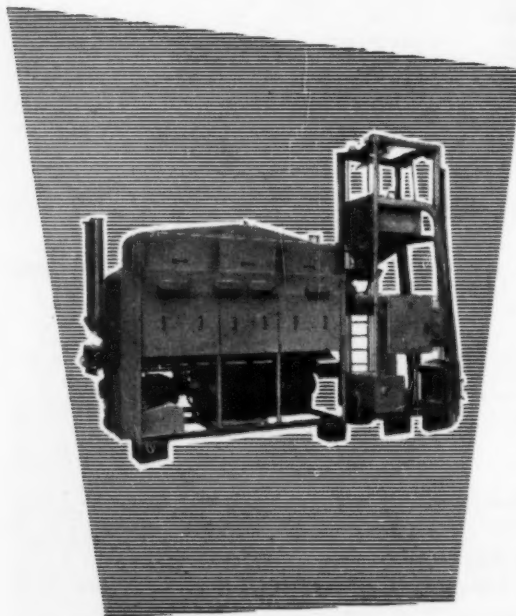
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THIS JOURNAL IS DEVOTED TO THE SCIENCE AND TECHNOLOGY OF PAINT APPLICATION, ELECTRODEPOSITION, VITREOUS ENAMELLING, GALVANIZING, ANODIZING, METAL SPRAYING & ALL METAL FINISHING PROCESSES. THE EDITOR IS PREPARED TO CONSIDER FOR PUBLICATION ANY ARTICLE COMING WITHIN THE PURVIEW OF "METAL FINISHING JOURNAL" AND ALL SUCH ARTICLES ACCEPTED WILL BE PAID FOR AT THE USUAL RATES.

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RIGHT, DEAD RIGHT

AMONG the many cautionary verses and jingles with which we have been indoctrinated since early childhood, there is one which, if memory serves us correctly, goes as follows

*"He was right, dead right, as he sped along
but he's just as dead as if he'd been wrong."*

While this provocative little couplet was obviously designed to advocate a greater degree of caution among the drivers of motor cars, the moral can have rather wider and more general implications than was perhaps intended by the original poet. Rightness, the quality of being right, particularly if coupled with invariability, is a most unpopular virtue, and the opinions of its practitioners are the least sought after of all. There is nothing quite so galling to those who make the normal percentage of ordinary human errors in the course of the daily round than to encounter the ineffable complacency of those vociferous individuals to whom error is unknown, and there are few delights sweeter than detecting chinks in the armour of correctness which they wear.

Apart from these isolated and odious individuals there is a whole class of persons to whom the quality of infallible correctness is traditionally attributed, and that is the customer. The customer is always right, and therefore it may be assumed that he is liable to incur all the displeasure and disregard which is the perquisite of such an attribute.

Looking a little closer at this invariable correctness on the part of the customer it can be seen that what is implied is that the customer has certain clearly defined requirements of the need for which he is aware, and that it is up to the supplying organizations to cater for these needs. This, however, is far from being the real state of affairs and the position is radically altered by the interplay of many complex factors. Any preconceptions held by a customer concerning the nature of his requirements must be subjective, and liable to be influenced by a whole host of sociological and economic considerations. They are in fact the resultant of such vectors as personal taste, environment and background, and they are highly susceptible to modification by such external influences as advertising and the dictates of "fashion." In fact to a very great extent the customer buys what the producer tells him he ought to buy and in doing so is under the impression that he is exercising free choice and is maintaining his inalienable right to be always right.

Customers however, are not only the retail purchasers of manufactured products, they are also buyers of industrial equipment and of industrial processes. They are the readers of technical journals and they are the members of trade and technical associations.

Having been at some pains to point out up to now that the free choice exercised by the customer is largely mythical, it now has to be said that he does in fact wield very effective power, a power put into his hands by the competitive system on which the majority of industry operates.

In the case however, of a technical Institute not offering the services to which a member considers he is entitled in return for his subscription, a different set of criteria obtains. Such an Institute exists to serve a technology, and the general interest may well conflict with the individual one.

A customer who withdraws his custom in these circumstances may well be exercising his right but it will probably turn out to be a dead right.

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by "PLATELAYER"

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LIGHTER LIGHT METAL

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by J. EDWARDS, B.Sc., Ph.D.*

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(see following page)

(left to right)

1. Mr. E. Marston (The National Cash Register Mfg. Co. Ltd.), Mr. C. Raysthorpe (M. L. Alkan Ltd.) and Mr. J. Dawson (Ferranti Ltd.).
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(left to right), Mr. H. Cann, Chairman of the Conference Social Sub-Committee discussing a point of organization with the President, Dr. T. P. Hoar and the Honorary Secretary, Dr. S. Wernick.

The sheet is spun to shape, machined, then polished with a coarse grade of diamond paste. To remove coarse particles embedded in the surface, the mirror, after mild cleaning, is anodized for 20 min. in 6 per cent. H_2SO_4 solution, then stripped in phosphoric-chromic acid solution. The anodizing and stripping are repeated, and followed by polishing with fine diamond paste. The complete wet processes are then repeated, except that the second anodic film is not stripped, but is sealed in boiling water and "cleared" in warm HNO_3 solution.

The authors report that anodizing and stripping is much more effective than electropolishing in giving a smooth, bright surface free from ripple. (Alkaline electro-polishing solutions were not given a full trial, however). They comment that the brightening effect of anodizing and stripping is apparently well known, although they found no reference to it in the literature. A patent, B.P. 627854 was in fact granted for such a process about ten years ago, although in this case the anodizing conditions were chosen to yield only thin films which were readily stripped.

Even the best mirrors produced by the above process retained a fine surface ripple. The second part of the paper describes photographic methods developed for assessing the severity of ripple, believed on the basis of a number of tests to be a function mainly of grain-size and orientation.

Precious Metals

In spite of very high internal tensile stress (about 40 tons per sq. in.), rhodium can be deposited

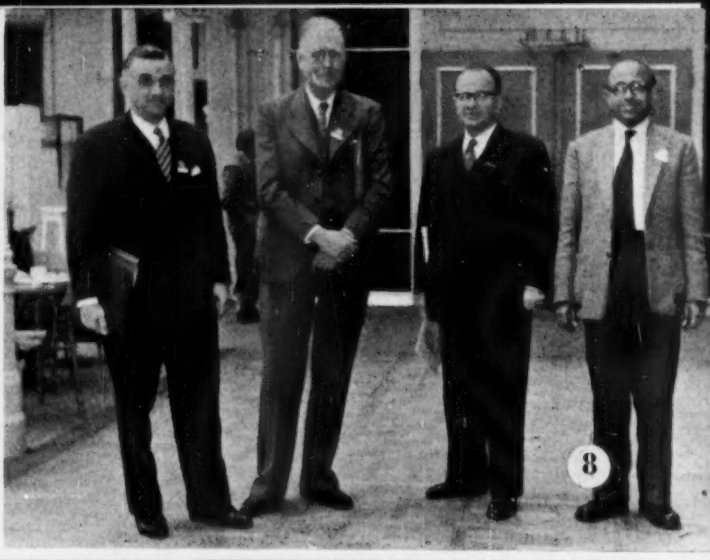
from a normal sulphate electrolyte up to a thickness of at least 0.0002 in. without cracking. This is ample for many applications. Nevertheless, thicker crack-free deposits might find new uses, particularly for protection in highly corrosive media. Furthermore, high stress is itself a hindrance in applications such as the production of printed circuits, and a substantial reduction in stress might therefore pave the way for important future developments. It is necessary, however, that the elimination of cracks and reduction in stress should not be accompanied by a deterioration in properties such as brightness and hardness. F. H. Reid reports a study of two possible ways of achieving this in his paper, "Some Experimental Observa-

CONFERENCE CAMEOS

(see following page)

(left to right)

7. Mr. R. B. Olliver (Roto-Finish Ltd.), Mr. D. M. Regan (The Pyrene Co. Ltd.), and A. W. Greig (Dexion Ltd.).
8. Mr. P. Morisset (Director, Centre d'Information du Chrome Dur), Mr. D. T. Chambaud (Société Fescol), Dr. S. Wernick (Consultant) and Mr. M. D. Tanton (British Council).
9. Mr. R. A. Wilding (Bristol Aero Engines Ltd), Mr. L. A. J. Lodder, (Imperial Smelting Corporation Ltd.), and Mr. S. J. Glossop (Bristol Aircraft Ltd.).
10. Mr. E. Marlow (Precious Metal Depositors Ltd.), and Mr. S. Dawson (W. Canning and Co. Ltd.).
11. Mr. G. J. Gilbey (Metals and Methods Ltd.), Mr. P. F. Walmsley (Albright and Wilson (Mfg.) Ltd.) and Mr. B. E. Bunce (Gillette Razors and Blades).
12. Mr. N. Gross (Wilmot Breedon Ltd.), Mr. E. J. Blewett (Wilmot Breedon Ltd.) and Mr. P. A. Cartwright (Wilmot Breedon Ltd.).





The President of the Institute, Dr. T. P. Hoar presenting the Hothersall Memorial Medal to Professor R. S. Hutton, who delivered the Fifth Hothersall Memorial Lecture.

tions on the Effect of Additional Agents on Stress and Cracking in Rhodium Deposits."

The first method consists in the addition of aluminium or magnesium ions to the electrolyte. These additions increase the thickness at which cracks appear, but tend also to make the deposit rough. Internal stress seems to be slightly increased by the additions, although detached deposits show no tendency to curl up. The author interprets these observations as indicating that on a flexible cathode, stress is partly relieved during plating by contraction of the deposit, while on a rigid cathode there is greater opportunity for occlusion of basic material in lattice faults, which later prevents the deposit from contracting, despite the stress. This is likened to the insertion of wedges between the adjacent turns of an extended spring. Such an explanation is only necessary, however, if it is demonstrated that deposits do not contract when they are detached: the fact that they do not curl may merely indicate that the stress is reasonably uniform throughout the deposit. A crucial test would be to measure the deflection of a flexible strip held rigid during plating and released subsequently.

The second process involves the addition of selenic acid to the electrolyte. In these solutions, the stress falls as the deposit increases in thickness, and even becomes compressive sooner or later, depending on the sulphuric acid concentration. Electrographic testing reveals no cracks in the deposits, although a very fine crack pattern is visible under the microscope and can be revealed more clearly by etching. Tests indicate, however, that the deposits can be regarded as crack-free from the point of view of protection against cor-

rosion. Furthermore, they are if anything brighter than conventional deposits, and almost as hard.

The factors leading to uneven dissolution and flaking of silver anodes were investigated in various silver-plating solutions by R. R. Benham. In "Some Observations on Silver Anodes" he reports that pure, annealed anodes having small equiaxed grains behaved well over the widest range of conditions. Anodes with larger grain-size were satisfactory in a normal solution, but corroded unevenly in the presence of organic contaminants and in high-speed solutions. Anodes containing small quantities (0.1 per cent.) of manganese, iron or copper and unannealed anodes behaved rather worse, but were reasonably satisfactory in the normal solution.

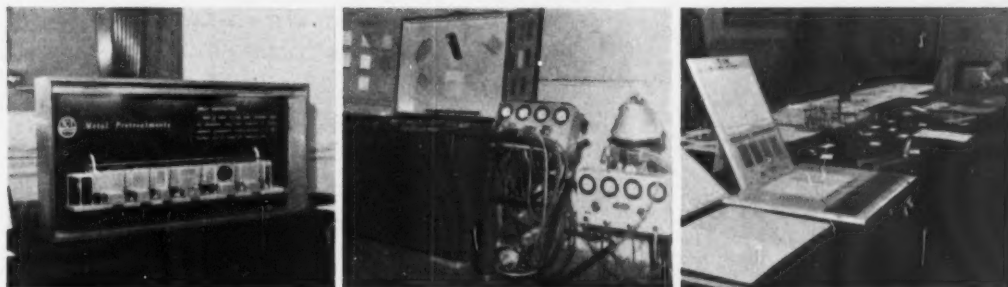
CONFERENCE CAMEOS

(see following page)

(left to right)

13. Mr. J. J. Dale (Defence Standards Laboratories, Commonwealth of Australia), and Mr. A. F. Brockington (W. Canning and Co. Ltd.).
14. Mr. J. L. Melse (N. V. Philips, Eindhoven), Mr. M. J. Reidt (N. V. Van der Heem, Holland), and Dr. P. Baeyens (N. V. Philips, Eindhoven).
15. Mr. U. F. Marx (Wilmot Breeden Ltd.), Mr. W. K. Bates (Albright and Wilson (Mfg.) Ltd.), Mr. F. H. Wells (Albright and Wilson (Mfg.) Ltd.), and Mr. F. C. Porter (Aluminium Development Association).
16. Mr. R. B. Olliver (Roto-Finish Ltd.) and Dr. H. W. Dettner (Schering A.G.).
17. Mr. M. Massard (Société Studler, Paris) and Mr. J. A. Bechtold (M. L. Alkan Ltd.).
18. Mr. H. Jenkins (The Pyrene Co. Ltd.), Mr. B. Freeman (The Pyrene Co. Ltd.) and Mr. W. T. Lee (Silvercrown Ltd.).

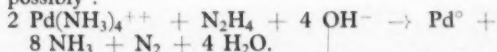




A view of some of the stands at the small technical exhibition staged during the Conference.

In "Electroless Palladium Plating" by R. N. Rhoda, a process is described for depositing palladium by catalysed chemical reduction. Most metals are effective catalysts, including palladium itself, so that thick coatings are possible. The plating solution contains a palladium-amine complex (ammonium hydroxide is a convenient amine for the purpose), a stabilizer such as the disodium salt of EDTA, and hydrazine as reducing agent, added when plating is due to begin. A bath operated at 80°C. is suitable for individually suspended articles. For large quantities of small parts, a different solution is recommended, operated at 35°C. in an oblique plating barrel; the rate of deposition is, of course, lower under these conditions.

The author has examined the effect on the rate of deposition of variations in the temperature and composition of the solution. He reports a rapid increase with increase of temperature, almost linear above 40°C.; spontaneous decomposition tends to occur above 70°C. The rate increases rapidly at first and then more slowly with increase in the palladium or hydrazine concentration; when the latter is varied, a limiting rate of deposition is reached at a molar ratio of palladium to hydrazine of 1 : 2, indicating that the reaction occurring is possibly:



Unfortunately, the standard conditions under which these tests were made is not reported. It is claimed that the efficiency of the process based on hydrazine consumption is 70 per cent., although a plot of rate of deposition versus time suggests a lower figure.

Owing to the nature of the reducing agent, the deposits are pure and not alloyed as are metals from some other electroless processes. The deposits are generally ductile and adherent.

Ralph H. Atkinson is the author of "Electrodeposition of Platinum from Chloroplatinic Acid." In this paper experiments are reported which enabled conditions to be defined for the deposition of ductile platinum from aqueous solutions

containing chloroplatinic acid and hydrochloric acid. It appears that the rate of deposition must exceed a certain value which decreases with increasing acidity of the bath, if the deposit is to be ductile. At lower rates of deposition, the deposit is harder and either cracked or very brittle. At much higher rates, the deposit becomes rough or spongy. Unfortunately the critical conditions cannot be specified in terms of current density since the plating rate is influenced by other factors, particularly the concentration of chloroplatinous acid and the degree of agitation. The latter is particularly important: little or no metal is deposited if stirring is too vigorous or if the solution is completely still. Fortunately it was found that at fairly constant temperatures in the range 40-70°C. thermal convection currents could provide the right amount of stirring for satisfactory deposition of platinum.

Possibly the most interesting part of the paper is the author's proposed explanation of the dependence of deposit quality on acidity and plating rate. He assumes that hardness and brittleness depend largely on the amount of hydrolytic matter occluded in the deposit. This view is supported by the observation that the deposits blister when heated to 1500°F. in argon, and that the extent of blistering

CONFERENCE CAMEOS

(see following page)

(left to right)

19. Mr. A. A. B. Harvey (Sunbeam Anti Corrosives Ltd.), Dr. W. E. Hoare (Tin Research Institute) and Prof. J. W. Cuthbertson (University of Nottingham).
20. Mr. R. Clegg (Silvercrown Ltd.), Mr. A. J. Baldock (Silvercrown Ltd.), and Mr. W. E. Cattley (Walterisation Co. Ltd.).
21. Mr. D. Hughes (Metachemical Processes Ltd.), Mr. J. A. Scott (Vickers-Armstrongs (Aircraft) Ltd.), and Mr. F. T. Terrill (Vickers-Armstrongs (Aircraft) Ltd.).
22. Dr. J. W. Price (Tin Research Institute) and Dr. L. L. Shreir (Battersea College of Technology).
23. Mr. R. R. Benham (Johnson Matthey and Co. Ltd.), Mrs. S. B. Gane and Mr. S. B. Gane (Johnson Matthey and Co. Ltd.).
24. Mr. A. Mohan (London and Scandinavian Metallurgical Co. Ltd.), Mr. R. M. Angles (Tin Research Institute) and Mr. M. Clarke (Tin Research Institute).



decreases with increasing acidity of the plating bath. In this solution it is unlikely that basic compounds are formed within the cathode layer (as is assumed to occur in Watts nickel solution, for example) since, owing to the absence of hydrogen discharge, and to the liberation of hydrochloric acid when platinum is deposited, the pH is probably lower here than in the rest of the bath. It is concluded therefore that the whole bath contains a low concentration of hydrolytic matter, possibly in a colloidal form.

The rate of incorporation of such material in the deposit will be controlled by the rate at which it can reach the cathode surface — a function of its concentration and to the degree of agitation. The rate will be more or less independent of current density; consequently, raising the plating rate gives progressively softer deposits with a lower impurity content.

The author develops the argument further, and shows how the way in which the critical plating speed changes with acidity can be predicted, if it is assumed that the hydrolysis product responsible for brittle plates is trihydroxytrichloroplatinic acid.

Nickel Plating

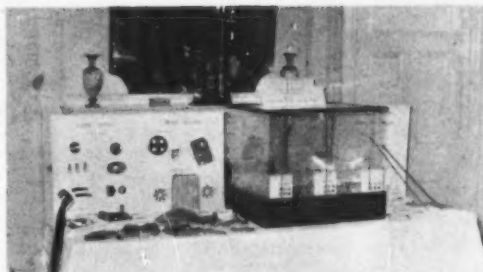
The paper by J. Edwards on "The Properties of Bright Nickel Electrodeposits in Relation to the Period of Service of the Plating Bath: III. — Composition and Microstructure" completes the account of an investigation of the effects of ageing of organic bright nickel solutions, the first parts of which were presented at last-year's Conference.

Deposits prepared at intervals during the life of Super Gleamax and Efco Udylyte solutions were analyzed and examined metallographically. In both types of deposit the carbon, oxygen, hydrogen and nitrogen contents tended to increase with the length of service of the bath; comparison with data presented earlier indicates that there is a definite relationship between the ductility of the deposits and the amount of material (addition agents and impurities) included in them. The results also suggest that the incorporation of such organic material may possibly reduce to some extent the occlusion of inorganic matter.

The additions of anti-stress agent made periodically to Super Gleamax solution tended to reduce the amount of organic material in the deposit — it is suggested that this may explain the beneficial effect of such additions on ductility.

Probably the most important conclusion to be drawn from this work is that a thorough investigation of the factors controlling the amounts of organic substances occluded in electrodeposits could hardly fail to assist greatly in explaining the effects of such substances on both solution and deposit properties.

Metal deposition from the vapour phase, by



Part of the small private exhibition put on show during the Conference by M. L. Alkan Ltd.

thermal decomposition of a volatile compound of the metal, is unlikely ever to compete with electrodeposition in applications where the latter process is feasible. Vapour deposition may, however, furnish a process for producing coatings of metals which cannot be deposited by other means, and also for coating substrates which are unsuitable for wet processes on account of reactivity or porosity, for example.

In "Nickel Plating by Thermolysis of Nickel Carbonyl Vapour" by L. W. Owen, the difficulties posed by vapour deposition are considered and brief descriptions are included of plants suitable for the deposition of nickel from carbonyl vapour, using reduced or atmospheric pressures. The use of atmospheric pressure is the more recent development, which opens up the possibility of coating larger and more complex articles. Problems of control are, however, more difficult than with the low pressure method.

Under the best conditions, the coatings obtained are comparable with high-quality electrodeposits, but variations in temperature, pressure or rate of vapour flow and slight oxygen contamination can result in inferior deposits. It is understood that, in the final version, this paper will contain a good deal of additional information about the structure and mode of growth of the deposits.

K. Szmidt, T. Zak and Zb. Kwiatkowski in "Rapid Quantitative Methods for the Determination of Brighteners, Levellers and Anti-Pitting Agents in Nickel Electroplating Baths" show how various physicochemical methods can be used to determine certain addition agents in bright nickel plating baths.

Polarography is a suitable method for estimating metallic ions (such as Cd^{++}) used as brighteners. The determination can be made on a sample of the plating solution itself, adjusted to pH 4.8-5.

Organic brighteners such as *p*-toluene sulphonamide and wetting agents such as sulphonated isopropyl-naphthalene can be determined from their influence on the polarographic maximum of oxygen dissolved in the solution. Both types of addition agent lower

the maximum, and at moderate concentrations eliminate it completely. To ensure adequate sensitivity and to eliminate interference from nickel ions, measurements are made on a diluted sample of the plating solution.

The concentration of wetting agents can also be estimated from surface tension measurements (made using the maximum bubble-pressure method). When a brightener and a wetting agent are present in the same solution, both can be determined by reference to polarographic and surface tension data.

Where simpler techniques are not available, these analytical methods could prove very useful, provided that impurities do not interfere, although the polarographic methods would be rather expensive for the ordinary plater. In order to construct the required calibration curves, it is not strictly necessary to know what the addition agents are, so long as they are available separately, but it would clearly be an advantage, in using these techniques, to have such information.

Alloy Plating

A paper on "Electrodeposition of Copper-Nickel Alloys from Citrate Solutions" by B. H. Priscott shows that sound alloys can be electrodeposited at reasonable efficiency from solutions containing copper and nickel sulphates, trisodium citrate and a small amount of sodium chloride (added to improve anode efficiency). From a study of the effects of varying the solution composition and plating conditions, it is concluded that the optimum conditions are: copper + nickel 0.19M, trisodium citrate 75 g. per l., sodium chloride 2 g. per l., pH 5, 55 C., 20 amp. per sq. ft. The composition of the deposit can be controlled by varying the ratio of copper and nickel in the solution.

Polarization is high in this solution and the cathode efficiency falls with increasing current density. Consequently, the throwing power is extremely good. Unfortunately, the composition of the deposit also changes quite rapidly with change of current density, the copper content falling, for example, from 80 per cent. at 10 amp. per sq. ft. to 60 per cent. at 40 amp. per sq. ft. The total metal content of the bath is low, and it seems a pity that the effects of varying plating conditions and the concentration of other constituents were not explored in solutions of higher metal ion concentration. The cost of any baths based on citrates will of course be rather high.

In contrast to the deposition of copper-nickel alloys, that of copper-tin alloys is well-established commercially. A paper by W. T. Lee on "Bronze Plating from Modified Stannate Cyanide Baths" is concerned with the alloy containing approx. 90 per cent. copper and 10 per cent. tin

which was first deposited more than 20 years ago but did not attain permanent industrial use until much more recently. Introduced in the first instance as a substitute for nickel, when that metal was particularly scarce, it established itself in time as an independent finish and as an undercoat for various other coatings. Certain improvements in the process helped in this development, although basically the solution and its operation remain the same.

The paper includes a useful summary of the operating characteristics of the solution based on sodium salts, showing the factors controlling deposit composition, current efficiency, rate of carbonation and throwing power; there are few data on the properties of the deposits. Brief reference is made to the potassium-based solution, and to a lithium-based solution which has apparently performed satisfactorily on a pilot-plant scale. Trouble with carbonate build-up is avoided in the latter solution, since lithium carbonate is only slightly soluble in it. Cost is likely to be prohibitive, however.

Embrittlement, Fatigue and Hardness

The use of nickel sulphamate solutions for the deposition of nickel on an industrial scale is comparatively new, but the process continues to gain favour for specialized electroforming applications and to attract widespread attention in the plating industry generally, by virtue of the claims made for it. In spite of a few earlier publications, the assessment of these claims has been rather difficult, and for this reason the contribution by D. A. Fanner and R. A. F. Hammond on "The Properties of Nickel Electrodeposited from a Sulphamate Bath" is particularly welcome.

From the results of a thorough and painstaking investigation, the authors conclude that deposits from the sulphamate deposit have a low internal stress, as claimed, even in the absence of stress-reducing agents. Otherwise, the deposits are very similar to Watts nickel deposits, in respect of hardness, ultimate tensile strength, ductility and microstructure, and react similarly to changes in the operating variables. The loss in fatigue strength of steel due to nickel plating is only slightly reduced by the substitution of a sulphamate for a Watts type solution. The sulphamate bath is reported to be the more prone to pitting; although this defect has been commented on before, however, it is believed that it can be overcome.

R. L. Samuel and N. A. Lockington presented a paper with the title, "The Brittle Fracture of Ultra-High Tensile Steels in Relation to Surface Coatings." They carried out sustained load tests on notched tensile specimens of one type of ultra-high-tensile steel coated with various



Personality Spot

T. P. HOAR, M.A.

Ph.D. (Cantab), B.Sc. (Lond.), F.R.I.C., F.I.M.

President, Institute of Metal Finishing

THOMAS PERCY HOAR was educated at Sir Joseph Williamson's Mathematical School, Rochester, and Sidney Sussex College, Cambridge, where he gained an Open Scholarship in 1926. He began research with Dr. U. R. Evans, F.R.S., in 1930, working on the mechanism of metallic corrosion, and obtained the degree of Ph.D. in metallurgy in 1933. From 1933 to 1939 he carried out research at Cambridge financed by the International Tin Research and Development Council. During the 1939-1945 war he was engaged in research, development and advisory work for the Ministry of Supply and the Admiralty, mainly on problems of corrosion, protection and metal finishing, and also began a long association with the metal and chemical industries as a consultant in these fields. Since 1946 he has been University Lecturer in Metallurgy at the University of Cambridge, and with a research team has carried out a wide range of researches in chemical metallurgy, many of them on various aspects of metal finishing and metal surfaces generally.

types of electrolytic and vapour-deposited coatings; some of the tests were conducted under corrosive conditions. With stresses around 80 per cent. of fracture strength, cadmium-electroplated specimens failed in 10-100 hours, nickel + chromium plating gave inconsistent results, while nickel-plated and zinc vapour-plated specimens resisted delayed fracture. In contact with sodium chloride solution, metal-coated and uncoated test-pieces failed rapidly at even lower stresses, but a silicone lacquer was found to provide adequate protection. Other corrosive agents such as tap water and ammonium carbonate solution did not induce fracture. Cathodic charging of uncoated specimens during loading caused rapid failure, tending to confirm that the embrittlement observed on other specimens was due to hydrogen generated in the plating process or during corrosion.

A further contribution on a similar subject was provided by K. Sachs and S. H. Melbourne. In "Hydrogen Embrittlement of Steel by Cathode Charging, Pickling and Cadmium Plating," they were mainly concerned to evaluate the relative contribution to embrittlement of the various processes in a commercial barrel plating sequence. The specimens used were carbon steel coiled springs and short lengths of mild steel screw wire. The test methods—stretching of the springs and repeated bending of the wires—were far from ideal for detecting embrittlement, but seemed to give significant results. The wires were severely embrittled by pickling and recovered ductility to some extent during cadmium plating. The springs were brittle after pickling but even more so after plating. This difference is attributed to the thinner cross section of the spring wire. Within a single barrel load, embrittlement seemed more variable with springs than with wires. Quite large variations were observed, however, between different loads of wire specimens, indicative of the inconstancy of works processing conditions.

A brief paper by V. R. Ramanathan on "Hardness of Electrodeposited Speculum Metal and Other Tin-Copper Alloys" concluded the session concerned with mechanical properties. Tests showed that, of the tin-copper alloys examined, speculum has the greatest hardness. From studies of the effects of variations in deposit thickness and load on the indenter, the author concludes that with a coating softer than the base the hardness value is unaffected by the base until the indenter has almost penetrated the coating, while with a base harder than the coating, false values are obtained if the penetration exceeds 1/8 the coating thickness.

Fundamental Studies and Techniques

For many years, the presence of pores in electro-deposited coatings which are more noble than the

basis metals to which they are applied was considered to be the main factor controlling their protective value. Consequently, much effort was put into the development of porosity tests intended to reveal individual pores or to estimate their total area, without attacking the coating. Various test methods, partially fulfilling the required conditions, were widely used for industrial control and research purposes. So far, at least, as nickel + chromium coatings are concerned, interest in porosity tests slackened as it was realized that true porosity is largely absent from nickel coatings of a thickness considered suitable for external use, and that pitting corrosion is the most important mode of failure of such coatings in service conditions. Attention was therefore directed to the development of accelerated corrosion tests, such as the Corrodokote, sulphur dioxide, and acetic acid salt spray tests, which have an undoubtedly corrosive effect on nickel + chromium coatings.

But the trend ought not to go too far. Porosity arising from basis metal or solution defects can still play a part in the breakdown of even quite thick coatings—it is crucial in the case of the more corrosion-resistant deposits such as tin-nickel. Furthermore, in the absence of satisfactory tests, there is no really quantitative evidence of how far the pitting corrosion of nickel is influenced by the porosity of the top coat of chromium. Finally, the measurement of porosity in thin deposits provides one useful means of learning something about their mode of growth.

The paper by M. Clarke and S. C. Britton on "An Electrochemical Method of Obtaining an Index of Porosity of Metal Coatings" is therefore timely, and specially welcome as it proposes a new form of test yielding quantitative data, and describes a series of well-planned experiments enabling a preliminary assessment, at least, to be made of the capabilities and limitations of the technique.

The method depends on treating the coated metal anodically in conditions such that the current passes almost entirely *via* the basis metal exposed at pores, and the polarization of the basis metal is insensitive to changes of current. The displacement of potential as the current is varied should then depend on the resistance of the electrolyte in the pore channels, and thus be a function of total pore area and of the thickness of the coating.

One might well expect such conditions to be impossible of attainment, but examination of the anodic polarization curves for steel and tin-nickel plate, which together constitute the combination chosen by the authors for most of their work, shows these materials to be practically ideal for the purpose. The potential of tin-nickel in 3 per cent NaCl solution rises very steeply as the current is increased, the deposit remaining passive up to a

potential well in excess of that at which the potential of mild steel in the same solution becomes virtually independent of current density. If tin-nickel-plated steel is anodically polarized, therefore, using very small currents, the potential rises linearly with current density, and, according to the theory, the slope of the curve is indicative of the resistance of the electrolyte in the pores and, therefore, in an inverse sense, of the porosity of the coating. In confirmation of this, it is shown that $\frac{dV}{dI}$ increases roughly in proportion to the resistivity of the electrolyte, and that it also increases with increasing thickness of the coating.

The rate of increase of $\frac{dV}{dI}$ with thickness is much lower than might be expected in view of the rate of decrease in the number of pores revealed by the SO_2 test, which is regarded by the authors as a satisfactory porosity test for tin-nickel coatings. The discrepancy is attributed to the tendency for the finest pores of the highest resistance to be the ones which are most readily covered up as thickness increases. In very thin deposits, the distribution of pore sizes and the rate at which pores are sealed off should depend on the mode of nucleation and growth of the deposit. Measurement of the relationship between $\frac{dV}{dI}$ and thickness ought therefore to throw light on these factors if a suitable mathematical treatment were developed.

The authors show that, if appropriate conditions are chosen, linear plots of potential against current can be obtained for speculum, nickel, copper and tin, as well as tin-nickel, on steel; the slope of the curves increases in the expected manner with deposit thickness.

The test is unlikely to be suitable for control purposes—it is rather tricky to carry out and might well lack sensitivity in the region of low porosity. It could nevertheless prove invaluable for studying the effect of process variables on porosity, and, with further elucidation of its mode of operation, might assist in fundamental studies of the growth of electrodeposits, as mentioned above.

In "An Apparatus for the Continuous Measurement of Dissolution of Metals", T. S. de Gromoboy and L. L. Shreir describe a method they have used to obtain a continuous measure of the weight-loss of aluminium during chemical polishing. It depends on the measurement of the electrical resistance of a thin metal wire, which increases as the cross-section of the wire decreases during dissolution—the principle has been used previously in corrosion studies. A thin aluminium wire is wound non-inductively round a glass rod which can be rotated at fixed speeds in the chemical polishing solution. The

resistance of the wire is measured continuously using alternating current. The authors report results obtained in a solution of phosphoric and nitric acids.

A. K. N. Reddy and H. Wilman in "Structure and Growth of Iron and Chromium Electrodeposits on Copper Single-Crystal Faces" describe an electron-diffraction investigation of iron and chromium deposits applied to electropolished crystals of copper. It is the first detailed study of the deposition of a body-centred cubic metal on a face-centred cubic metal.

Four main stages of growth of iron are distinguished by the authors: (1) epitaxial orientation, providing the best possible fit, but apparently without an initial pseudo-morphic growth in the face-centred cubic form, (2) development of twinning, (3) either a wide range of orientations or random polycrystalline structure, (4) development of one-degree ("outward growth") orientation.

Chromium deposits, not studied as fully as iron, developed similar epitaxial orientations, as might be expected in view of the similarity of the spacings in the two metal lattices.

In "Optical Methods of Studying Surface Finish", O. S. Heavens reviews several well-known methods of investigating polished and electrodeposited metal surfaces, and describes in addition a method believed to be new in its application to metal finishing. The established procedures comprise straight microscopy, including dark field and phase-contrast methods, interference and light-profile microscopy, multiple-beam interferometry, and reflectivity measurement. The new method also depends on reflectivity measurements, using, however, plane-polarized light.

It can be shown by the application of electromagnetic theory to the case of reflection at the plane surface of a homogenous, isotropic material that, for light incident at 45 deg., $R_s^2/R_p = 1$, where R_s and R_p are the reflectances of light plane-polarized so that its electric vector is perpendicular and parallel, respectively, to the plane of incidence. This ideal result is not attained in practice, but the extent to which a surface approaches the ideal is indicated by the observed value of $R_s^2/R_p \equiv \sigma$. It is found that σ decreases with increasing surface roughness, and is in fact a more sensitive measure of surface finish than the reflectance itself; furthermore, knowledge of the true reflectance for the particular metal is not required. The author reports values of σ found on various electrodeposits.

The use of optical techniques to study oxidized metal surfaces is also referred to. Using multiple-beam interferometry on transparent films it is possible to measure both the height of the film surface above the original (untreated) surface and the depth of the metal-film interface below it.

The refractive index of the film material, if not known, can be determined by measuring the angle of incidence at which the reflectance R of the filmed surface is the same as that of the metal. For non-porous films, the volume ratio of the oxide can then be calculated.

It is unfortunate that the paper by *H. R. Thirsk* and *W. F. K. Wynne-Jones* on "**Some Techniques in the Study of the Rate of Deposition and Formation of Inorganic Films on Metal Surfaces**" should have been one of the few which were not available in one form or another to the Conference delegates. Only a summary was provided, and since the authors were allowed only a short time in which to present their paper, it was quite impossible to do it justice.

In spite of the very extensive literature on electro-deposition, very little is yet known concerning the kinetics of the process. This paper shows how recent developments in experimental and theoretical techniques could, if adequately applied, do a great deal to advance our knowledge in this field. The kinetic parameters requiring determination are defined, and it is shown how the application of relaxation methods enables measurements to be made on fast processes involving anodic or cathodic deposition. In such methods the response of the electrode to a perturbation from equilibrium is followed as a function of time. The main categories are potential step, current step, and a.c. methods, all of which have been applied to deposition processes, mainly on mercury or amalgam electrodes.

A variant of the potentiostatic method, due to the authors and their colleagues, is described at greater length. The method has been applied so far only to anodic processes, but it is very likely that with suitable modifications, it would give equally valuable data about cathodic processes.

In order to distinguish the two stages of the overall electrode reaction, nucleation and subsequent growth, preliminary polarization at a given potential is followed by measurement of the current-time transient at a lower potential. The nuclei formed at the higher potential do not grow appreciably during the time this potential is maintained and they may be assumed to be of the same age and size. Since the nucleation constant varies rapidly with overvoltage, further nucleus formation at the lower potential may be neglected, and the growth rate should be described by a relatively simple equation based on a constant number of nuclei. It should be possible to deduce directly in how many dimensions the nuclei grow. Furthermore, by varying the time at the higher potential, the variation in the number of nuclei with time can be examined.

The experimental difficulties are considerable. An extremely sensitive potentiostat is required,

and both substrate and electrolyte need to be of the highest possible purity.

Organic Finishing

The paper by *R. E. Shaw* comprises a useful review of "**Developments in Metal Pre-Treatment**".

An important spur to development has been the availability of one-coat finishes which require thin, smooth phosphate coatings for satisfactory results. The necessary refinement of the coating can be obtained by the addition to the phosphating solution of polyphosphates or organic inhibitors; whichever addition is employed, a marked reduction in sludge formation is achieved, since less iron is dissolved from the work. Smooth coatings can also be obtained using hydrogen peroxide instead of the conventional accelerators. The process does not lend itself to dip application, but, if spray methods are used, it is possible to gain the advantages of operation at relatively low temperature. Sludging is considerable but apparently not very troublesome.

Economies in the use of fuel can be achieved by using cleaners and phosphating solutions which operate at low temperatures. Heat-saving can also be accomplished in dip processes by the use of a surface sealing layer of inert liquid in conjunction with surface active agents.

Solvent drying, alkaline derusting processes, and developments in conversion coatings for aluminium are also referred to in the paper.

The costing of industrial processes is a complex but necessary procedure, no less essential in a small paint shop than in the finishing department of a large manufacturing organization. Its function is to assist in reducing costs and raising productivity, in comparing the efficiency of alternative processes, and in estimating the cost of applying established processes to new work. *H. H. Norcross*, in his paper on "**The Measurement of Industrial Paint Finishing Costs**", is mainly concerned with the principles of costing in a factory doing repetitive work, although most of his recommendations could be equally well applied in other circumstances. A form of budgeting control is advocated for material, labour and overhead costs (or, at any rate, that part of the overheads for which the paint shop superintendent can be held responsible). A monthly statement should be prepared giving the estimated standard costs of materials and labour and the budgeted overheads (for the level of output achieved) as well as the actual expenditure under these heads. Examination of these figures, accompanied by a detailed analysis of the costs, should reveal where excess costs are incurred, and what action should be taken to reduce them.

(Continued in page 176)

Enamelled Aluminium in Building

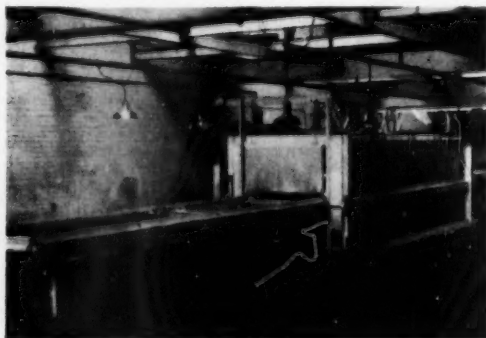
A NEW block of flats being erected at Hove, Dolphin Court lies on the north-east corner of a road junction a few yards north of the sea front; its main aspects are south and west, and each flat on these two facades has a balcony.

For decorating these, the architects have chosen vitreous-enamelled aluminium, in three colours — two of blue and one of pale yellow. The material and finish provides a high lustre with freedom from deterioration, even in the marine environment

of Hove. The aluminium was provided by the British Aluminium Co. Ltd., Norfolk House, St. James's Square, London, S.W.1., and the vitreous enamelling carried out by Ernest Stevens Ltd., Cradley Heath, Staffs., using frits supplied by Ferro Enamels Ltd. The bond between enamel and metal will resist minor damage, and the makers say that even severe knocks with local exposure of the metal will not give rise to progressive deterioration.

Stevens are making the panels under the trade-name "Judgelite" on plant that comprises, basically, chemical pretreatment tanks, spray booths, and a 250 kW electric resistance furnace. Pretreatment is normally carried out in caustic soda and nitric acid with intermediate washings, but this can be modified to suit specific requirements. Handled in batch fashion by overhead transfer conveyor, the sheets move through a process culminating in a final water rinse when the oxide film has been built up to the pre-firing stage, in which the sheet to be enamelled is passed into the furnace for a pre-determined period to complete the build-up of the film. Spraying of the enamel is done either manually or automatically depending upon the surface form; the panels are then re-introduced to the furnace along a driven roller table. Fusing of the enamel to the aluminium takes place at about 540°C. Furnace size is 20 ft. x 4½ ft. Fans are positioned in the roof to maintain uniformity of temperature. Although the workpieces are laid flat in travelling through the furnace, a perfect finish is achieved on both back and front by suitable jiggling. A feature of the finished product is that the sheet can be bent to a reasonable degree without cracking the finish.

Left—Flat and fluted panels in contrasting shades, and, below, Stevens' furnace line



AUTOMATIC POLISHING

With Special Reference to the Use of LIQUID POLISHING COMPOSITIONS

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(A paper presented at the Annual Conference of the Institute of Sheet Metal Engineering, London, November 5 and 6, 1958)

THE polishing of metals is a large and important industrial operation and is almost essential where bright decorative finishes, such as chromium plate, are required. While some polishing is carried out by burnishing or by tumbling and also, to some extent, by electrolytic methods, the main bulk of all metal polishing is done on abrasive wheels. For heavy metal removal, solid grinding wheels used wet or dry made of emery or artificial alumina are employed, but for the final operation—which is the chief concern here—soft polishing wheels are used. These wheels are made of a variety of materials such as felt, leather, canvas, calico, etc., and are built up of discs which are clamped and sewn together in a variety of ways.

For the rougher operations where an appreciable amount of metal must be removed "set up" heads are employed, an abrasive being applied to the periphery of the wheel and held there by means of an adhesive. The mixture of the adhesive (which may be a cold one or hot glue) and the appropriate grade of abrasive is brushed on to the head of the wheel and the whole is dried in an oven at a carefully controlled temperature. It is important that the degree of drying should not be excessive as otherwise the head becomes too brittle. For the subsequent polishing operation where a fine finish is required "set up" heads are not employed but a polishing composition is applied to the rotating wheel from time to time. This method is almost universally employed for obtaining a high degree of finish on metals.

Polishing Wheels

It is desirable that certain commonly employed terms should be defined, as they are generally used in special connotations in the polishing trade. The term "polishing" as employed in Europe covers all the intermediate operations between preliminary grinding and final colouring. In America, however, the term polishing refers only

to the operations carried out on "dressed" bobs or mops. The term "dressed" refers to the application of a hard head consisting of a glued abrasive on to the polishing wheel, as has already been mentioned. These hard polishing wheels are known as "bobs" and are usually made of felt or sometimes of leather and are often specially shaped for specific purposes. Mops are wheels made of cotton or calico and are softer than bobs, although they may also utilize a glued abrasive head. In the United States mops are referred to as "buffs."

Disc mops are made from whole discs of fabric held together in the centre by means of two washers to form a loose open wheel; a less resilient mop is made by means of different patterns of stitching. Where softer metals, such as aluminium or zinc, have to be cut down the stitched wheels are employed. A cheaper method of construction is to use off-cuts of material to produce *stitched piece mops*, which are considerably cheaper than the full disc type. Semi-circles and quarter circles are used, as are combinations of these with full discs. A variety of methods of stitching is employed, including circular, spiral, tangential and square sewing with the object of preventing distortion under pressure and to stiffen the fabric.

Folded mops consist of discs folded into quarters, each one being fitted successively into another until the full wheel is built up. This type of wheel holds the polishing composition better and may be used for cutting when rotated in one direction, and for colouring when run in the opposite direction. This is one type of "ventilated" mop, and such wheels are frequently used because it is recognized that cool running is an important advantage in the polishing operation.

The *continuous strip mop* is one of the most important types of ventilated wheel and is made from a single bias cut strip of fabric, not more than half the diameter of the mop, helically wound until the required thickness has been built up. The edge of such a mop is wavy by virtue of the fact that the fabric must be folded to compensate

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for the difference between the inner and outer circumferences of the wheel. Not only does this construction result in improved ventilation so that higher speeds and greater pressures can be employed without burning or charring, but also marking of the work is reduced.

Stitched mops are supplied in white or coloured materials, the former being stronger and more durable. The hardness of the fabric is very important since, if it is too soft, excessive wear will occur, while too hard a material will not hold the polishing composition satisfactorily. Often a combination of stitching and gluing is employed to give the correct degree of hardness.

The most recent development in the manufacture of polishing mops is the use of sisal fibre materials. These are woven into cloth and are used to manufacture mops in exactly the same way as normal calico. They can be obtained either in the form of finger mops or bias cut mops, and are largely employed for the cutting down of stainless and mild steels. They act as a very short staple brush and are largely replacing the tampico brushes for the finishing of ferrous metals. They are commonly used in conjunction with an emery bar compound or a liquid composition using alumina abrasive and have proved to be extremely successful, giving a very fast cut; in many cases they can replace cutting down with either abrasive belts or set-up wheels.

This is a very short summary of the principal forms in which stitched mops are available and only gives a general outline of the large variety of methods of making these. The centres used to enable the mops to be attached to the polishing spindles are in the form of a tapered arbor in this country, while on the Continent and in the U.S.A. parallel holes are employed. Correct balancing of the wheel, which is usually up to 12 to 14 in. in diameter, is essential since at speeds of between 2,000 and 3,500 r.p.m. any degree of out of balance will set up a large amount of vibration.

Abrasive Belt Polishing

An important fairly recent development in polishing has been the increasing use of continuous abrasive belts to replace set-up mops. These belts are run on a soft wheel, which may be of rubber or calico, together with an idler wheel at some distance behind it to maintain the correct degree of tension. Belts can be obtained in various grit sizes from 60 to 300 mesh and they can be run either dry or with a lubricant; they are used normally for carrying out initial cut-down operations prior to polishing with a calico or sisal wheel.

Polishing Compositions

Traditionally, polishing compositions consist of abrasives bound together with a grease base. They

are supplied in bars and are manufactured by melting a mixture of selected greases and the abrasive in a jacketed pan, casting the product into moulds. When held against the rotating buff the grease melts and the abrasive is left on the surface of the wheel. A good polishing composition should be designed to adhere to the polishing wheel just so long as the abrasive retains its cutting qualities, and leaves no residues to reduce the efficacy of fresh composition which is subsequently applied.

Polishing compositions have a complex action, the function of the harder types of abrasives being to remove the coarser irregularities in the base metal and to have a cutting action. Medium abrasives serve to burnish or flatten out the surface rather than to remove metal while the final "colour" is given to the metal by means of the finest abrasives. This last operation is facilitated by the local fusion of the micro-crystals of the surface and results in the formation of the non-crystalline Beilby Layer, which is characteristic of a polished surface.

The formulation of the polishing composition involves careful selection of the types of grease and abrasives used, a great deal depending on the absorptive properties of the abrasive itself for the grease. A high degree of fat absorption is desirable since this facilitates the adhesion of the composition to the polishing mop when it is applied and also makes for a mechanically firmer bar which will not fracture when pressed against a polishing wheel. Drier compositions are made by using high-melting stearine-type greases while softer ones utilize the lower melting tallows and waxes. Usually compositions required for cutting down are rather greasier than those employed in the final colouring operations which tend to be rather on the dry side. However, when manual polishing operations are carried out different polishers have their own ideas as to the types of compositions they prefer, while other factors such as wheel speeds and applied pressures are not without influence.

Abrasives

The abrasives used include Tripoli powder, diatomaceous earth, green chromium oxide, emery, lime, etc. The requirements of the abrasives are rather critical since they must not only be hard but have a very uniform particle size which normally ranges from 50 to 180 mesh. Extreme uniformity of particle size is important since the presence of even a few large grains may cause severe scratching of the surface being polished. Abrasives normally have to be calcined in a furnace to make them suitable for incorporation in polishing compositions.

Tripoli compositions are very fast cutting and are specially suitable for producing a high lustre on non-ferrous metals. Tripoli is a hydrated silica

and generally comes from either North Africa or the U.S.A. American Tripoli has a smaller particle size and greater grease-absorptive qualities than the African material and is, in many respects, more suitable as a polishing abrasive. It is available in a variety of colours, such as grey, yellow or pink, depending on the impurities which are present. The amount and type of grease employed in the bar determines the type of composition necessary for specific purposes. Dry grades of Tripoli compound are recommended for lighter work and the more greasy ones for heavier cutting since the grease holds the abrasive on the wheel longer.

Lime compositions are made from calcined dolomite and are widely used as a last operation prior to plating as they help to remove grease residues, the best known grades being Sheffield and Vienna lime. Sheffield lime is a partially slaked material and is commonly applied in lump form directly on to the polishing wheel. Vienna lime has a high magnesium content and has, therefore, greater fat absorptive properties and for this reason is widely used in what are known as "white finish" compositions. It is the presence of the magnesium which permits this type of lime to be employed in polishing compositions since the high calcium limes are unsuitable because they will saponify the fats. Lime compositions must be carefully stored to exclude air and moisture since otherwise the lime reacts with the atmosphere to form calcium carbonate and the composition will disintegrate.

Emery is a natural mineral consisting mainly of a mixture of equal parts of alumina and magnetite. It is a very useful abrasive and can be obtained down to extremely fine grades, known as flour emery prepared by elutriation and sedimentation.

Green oxide compositions are employed for putting a high finish on stainless steel and also for finishing chromium plate. Synthetic alumina has particularly good cutting properties and, like emery, is employed where the highest standard of finish is required.

Metal polishing is, to a considerable extent, still regarded as an art and peripheral wheel speeds, pressures and other factors have to be closely watched if good results are to be obtained. Owing to the heavy nature of the work and increasing difficulty of finding skilled polishers, the present trend is towards mechanization of the polishing operation and a considerable variety of plant is now available to enable this to be carried out.

Composition Applicators

One of the major problems in the design and operation of automatic polishing machines has been the application of the polishing composition. Using the conventional type of composition bar, it is necessary to have a motorized reciprocating carrier which will slowly advance the bar on to the wheel

and withdraw it at periodic intervals. The design of a device of this kind to accommodate different lengths of bar and to inch it forward as it wears, always keeping the pressure of application constant, is a very difficult matter and such applicators require a considerable amount of maintenance, apart from their initial high cost. Wide bars such as may be needed for polishing sheet, are also very difficult to handle by means of applicators. In addition, their presence interferes with the efficient operation of dust extraction hoods which should conform as nearly as possible to the polishing head to reduce the dust problem. In fact, one of the advantages of automatic polishing is that it is possible to take dust away more effectively than with hand-operated spindles, but the presence of larger applicators can counter this feature. The biggest objection of all, however, to applicators is the fact that the composition wears down so rapidly that the machine must be stopped from time to time to enable a new bar to be inserted. As the bars at each spindle wear down at different rates and have to be replaced at irregular intervals, a constant watch must be kept to ensure that they are replaced in time; the stopping and starting of machines on each occasion quite often results in a loss of operating time of as much as 25 per cent. Not only is this a serious matter, so far as production is concerned, but there is a substantial waste of bar ends which cannot be utilized. Sometimes they are remelted but this is not an altogether satisfactory procedure. Attempts have been made to develop continuous bar compounds in the form of coils to reduce the need for stopping machines so frequently, but this involves making a composition which has the required properties but at the same time is sufficiently flexible to be coiled without cracking. No great success has been achieved so far.

Liquid Compositions

Liquid polishing compositions are of prime importance where automatic polishing is used. In fact, it can be said categorically that the optimum efficiency of an automatic polishing installation is more dependent on the use of liquid polishing materials than on any other single factor. In the U.S.A. it is estimated that some 70 per cent. of all automatic machines now use liquid compositions. Liquid compositions have been known for a considerable number of years and originally they consisted of oil or kerosene bases in which an abrasive was suspended. Experiments proceeded desultorily with them for a number of years but with limited success, the chief objections being (a) the tendency for the abrasive to settle in the medium and (b) the fire hazard resulting from the inflammable nature of the liquid phase.

Progress in recent years, however, in the field of emulsion technology and the use of the newer

surface-active materials has completely revolutionized the formulation of liquid polishing compositions, which are now always water emulsions of oils and greases in which the abrasives are suspended. The media themselves are relatively viscous and the suspensions are so stable, due to the close correlation between the specific gravities and viscosity of the media and the abrasive, that little or no settling out occurs even after prolonged standing. A very important feature of such compositions is that they can be formulated precisely to meet the requirements of the job, unlike bar compounds where the formulation is governed by the need to produce a bar which is physically strong enough to handle. The abrasives are applied to the rotating head by means of a spray gun with a large aperture, using an automatic timer operated by a solenoid valve. The compound is sprayed on to the wheel every seven to ten seconds, on the average, the duration of the applications being from $\frac{1}{2}$ second to 2 seconds. In hand-operated machines the spray can be put into action by means of a foot valve by the operator but it is not considered that liquid compositions are at present generally suitable for hand-polishing techniques; the reason is that not only may there be excessive throw off from the rotating wheel but the need for frequent changing of the grade of compound complicates the problem of utilizing liquid compositions too much. Liquid compositions are, therefore, almost entirely employed in automatic machines although intensive experimentation is proceeding with a view to making the process more suitable for hand-polishing methods. In automatic machines the valves which actuate the spray are cam operated. The cams can be located at any convenient point, such as the table chains on rotary machines or between the workholders, or on a slowly rotating shaft for small work. In the case of a constant-speed table-type or straight-line machine, cams should be very short. On straight-line machines they may be placed on work carriers, conveyor chains or belts and for long straight work the compound should be sprayed one very 12 or 18 in. which keeps the cutting rate of the mop constant and makes for a high degree of efficiency. The cam also serves to adjust the amount of compound which is sprayed on. It is better to control the amount of compound used by frequent short applications rather than to utilize excessively small gun apertures which may lead to plugging. The rate of metal removal is increased in this way. The angle and the distance of the jet from the rotating wheel are also rather critical. The quantity of compound used affects the rate of cut, but if this is increased excessively the efficiency of the process is reduced in relation to the amount of composition used. To avoid wastage of composition through throwing-off it is desirable to run the mops at as low a speed as it

is practicable and to apply composition while they are in contact with the work being polished. With modern compositions, gravity feed cannot be employed, pump operation from the container in which the material is delivered, or from a pressure tank, being normally used. Several guns, are quite commonly served by a single pressurized container. Pump operation is simple and safe but the problem of designing a pump to stand up to the abrasive is not an easy one. Where wide wheels are used, such as in the polishing of sheet, traversing or oscillating guns are employed.

One ancillary advantage of liquid polishing compositions is that as they contain emulsifying agents they are much more readily removed during subsequent cleaning operations (prior to electroplating, for example), than the solid bar type. This applies also to the machine itself which is much more easily kept clean. Also, their water content results in better cooling of polishing wheels so that the life of these can be extended by up to 50 per cent or more and the fire hazard is reduced at the same time. The wastage in the form of unused ends is entirely eliminated so that the cost advantage is substantially in favour of these compositions, which are remarkably economical in use.

AUTOMATIC POLISHING MACHINES

Automatic polishing machines are of the rotary-turntable or straight-through type and although they are often specifically designed for one particular kind of article, many machines are sufficiently versatile to enable a variety of components to be handled by the introduction of specially designed jigs.

Rotary-table Machines

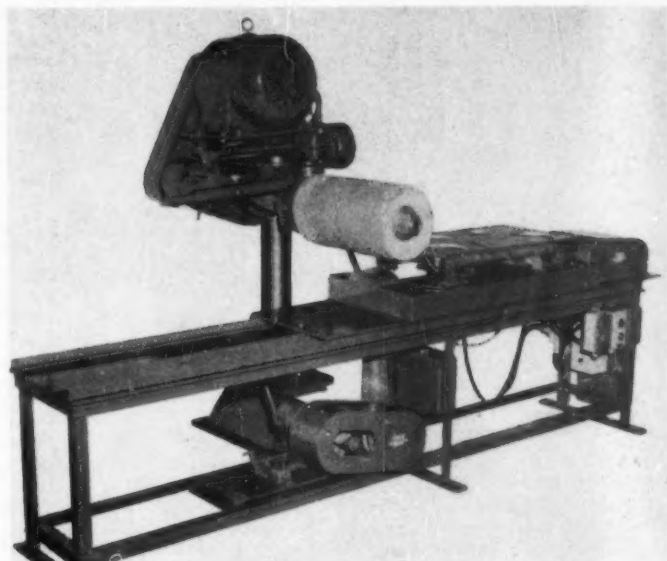
The rotary machine can be either of the continuous type, where the table is rotated at a slow speed, or an indexing type where the table is indexed every few seconds. The former machine is used for high production rates, on such components as door knobs, lipstick cases, fountain-pen caps and barrels, etc., while the latter is normally used when a lower production is required on larger articles such as saucepans, hub-caps and other components when are solids of revolution. The indexing type of machine can also be used for out-of-round shapes by means of special camming devices. One of the latest developments on the indexing type is the introduction of independent drive on every work spindle, thus enabling the direction of rotation of any component to be clockwise or anti-clockwise on different spindles as required, while the speed of rotation can also be varied from spindle to spindle.

Straight-line Machines

The straight-through type of machine is used primarily for the polishing of long articles such as bumper bars, mouldings, strip, sheet, and so on

Fig. 1.—Reciprocating-type straight-line machine.

(Courtesy of the Acme Manufacturing Co.)



while the rotary-type machine is capable of polishing smaller articles at very high rates indeed.

Special-purpose Machines

In certain cases there are components which are not suitable for the types of machines described above and in these instances special-purpose machines have to be used, particularly where large production is required. Typical machines are those for polishing tubes, in which the latter are passed between polishing wheels by means of feed devices and suitable chucks. These machines can be obtained with either one, two or three heads to give the standard of finish required and can

normally be operated by one man. Feed speed can be varied from 5 to 35 ft. per minute.

Sheet and strip can be polished on one side by what are known as flat stock polishing machines. Abrasive belts or normal polishing mops can be used in these machines depending again on the type of finish required and continuous processing can be obtained by means of a bank of two to six machines which are fed by rollers. Normally the spindle-carrying wheels are slowly oscillated to reduce the tendency for score marks to occur. Recently two very large special-purpose machines for the complete finishing of bumper bars have been installed in Europe. These make use of a

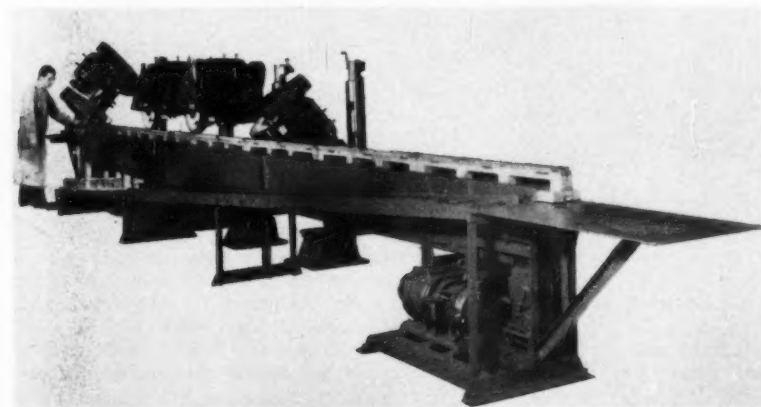


Fig. 2.—Fixture - return-type machine.

(Courtesy of the Acme Manufacturing Co.)

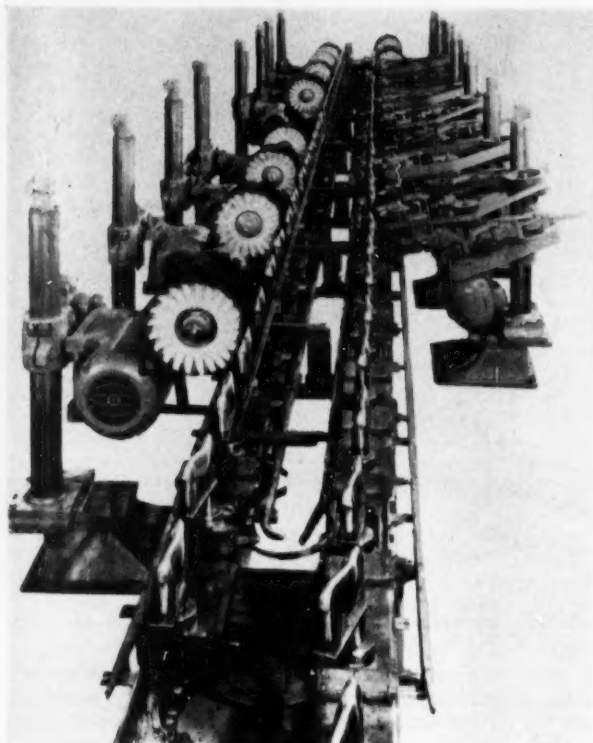
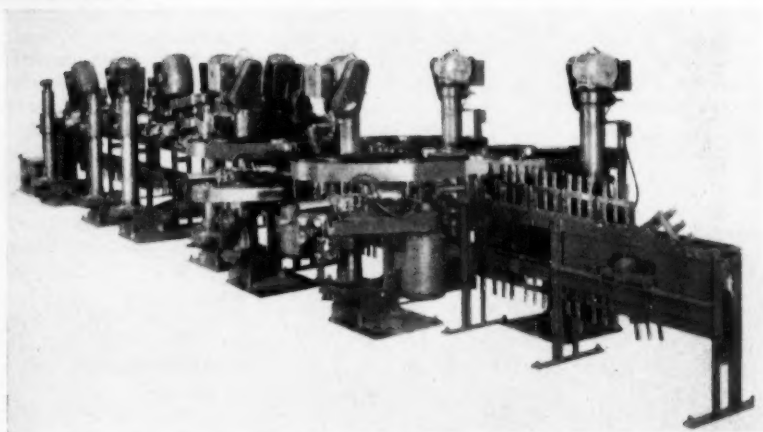


Fig. 3 (above).—Horizontal return-type machine showing simultaneous use of abrasive belts and mops. (Courtesy of the Acme Manufacturing Co.)

Fig. 4 (right).—Rectangular-type machine, using a combination "of straight-line and "under-and-over" mechanisms. (Courtesy of the Acme Manufacturing Co.)



combination of the "straight-line" and "over-and-under" types of machine to finish completely "wrap-round" bumper bars. These are very large machines using 36 polishing heads and give complete coverage of copper plated bumper bars at the rate of 200 per hour. In one particular European plant one of these machines has replaced 40 hand-operated spindles.

1. Reciprocating-type Machine

In this machine the work is reciprocated back and fourth under one or more adjustable polishing heads. The machine has a table on which a work-holding platen is mounted, this being actuated by a motor-driven worm gear and a rack and pinion arrangement. It has an adjustable stroke mechanism operated by a reversing control and two limit switches; if necessary, a solenoid-operated timer control can also be installed to permit the work to reciprocate under the polishing wheel for a predetermined time cycle. A typical machine of this type designed for the polishing of stainless-steel stove tops is shown Fig. 1.

This type of machine is normally used for long extrusions, architectural mouldings, nameplates and larger components such as stainless-steel stove tops, large radiator grilles, etc. The length of the machine is controlled by the component length and the number of polishing heads required, with a minimum of twice the length of the component, while platen speed can be varied from about 10 to 40 ft. per minute. Loading and unloading is carried out at the same end.

2. Fixture-return-type Machine

In this type loose fixtures are mounted on platens which are carried through the polishing sequence by means of dogs mounted on a conveyor chain powered by a variable-speed drive (Fig. 2). The platens are automatically disengaged from the driving dogs and slide on to an unloading platform after the polishing operation, the fixtures being

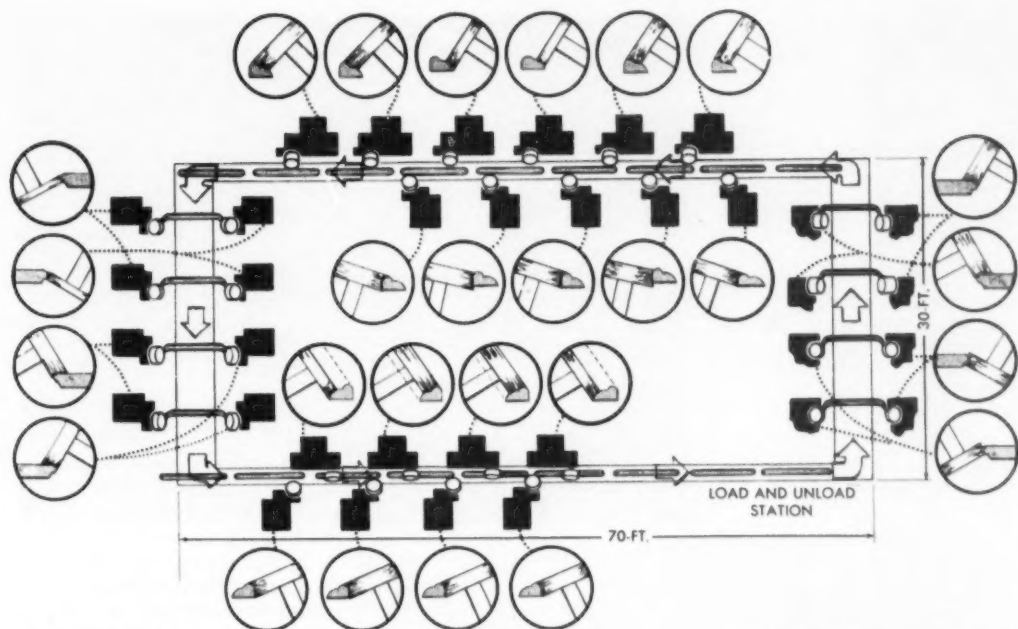


Fig. 5.—Floor plan of rectangular polishing machine shown in Fig. 4.

(Courtesy of the Acme Manufacturing Co.)

returned to the loading end either by a motorized belt conveyor or by a roller track. Usual fixture speeds are approximately 8 to 32 ft. per minute and many different components can be handled on this machine.

3. Horizontal-return-type Machine

The horizontal-return-type machines are useful for the polishing of windscreen frames, toaster bodies, refrigerator shelves and similar articles. Loading and unloading are at one end and the

components travel round the machine, which may be up to 60 ft. long, at speeds from 12 to 48 ft. per minute. These machines can utilize special camming arrangements in conjunction with fixtures on the platens so that articles can move and swivel into position for each successive polishing operation. A chain-driven sprocket is mounted on a gear that is pinion driven through a worm gearbox coupled to an adjustable-speed drive, the motor being connected to the latter by means of a fluid coupling. Platens are provided within the frame of the

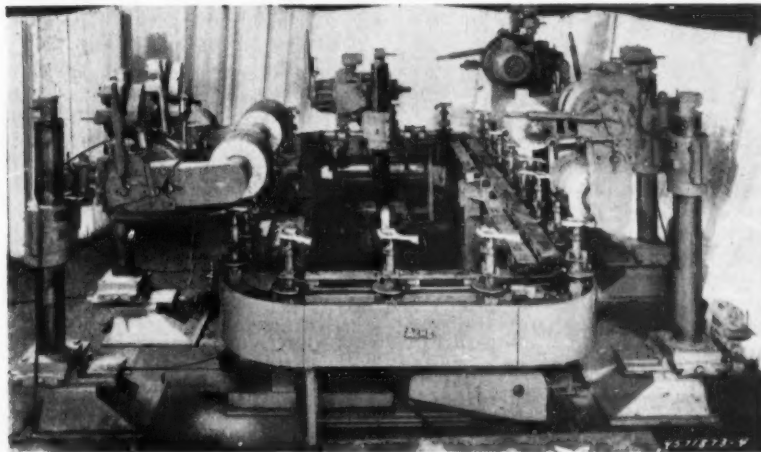


Fig. 6.—Universal-type machine for polishing tail lamp bezels.

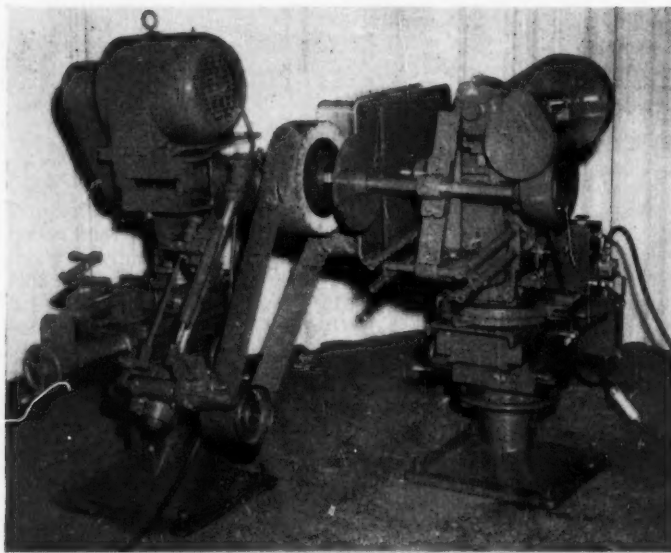
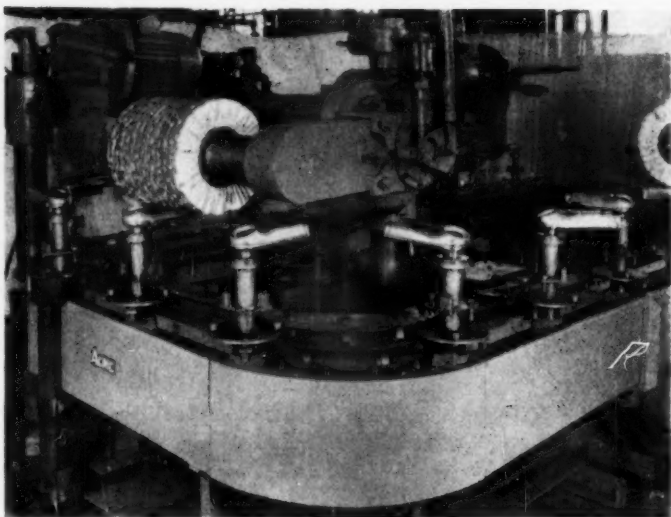
(Courtesy of the Acme Manufacturing Co.)

Fig. 7 (right).—Close-up of machine shown in Fig. 6 showing camming arrangement.

(Courtesy of the Acme Manufacturing Co.)

Fig. 8 (below).—Semi-automatic machine for polishing stainless-steel sink units, using an abrasive belt.

(Courtesy of the Acme Manufacturing Co.)



machine to act as fixture holders. The platens are driven by special platen carriers, each having two sealed ball bearings and assembled to the sprocket chain. A variation on this type of machine is the "over-and-under" type in which the fixtures return beneath the machine to the load and unload stations at each end. Such machines can be up to 80 ft. long and are suitable for polishing articles such as bumper bar ends, cigarette lighter cases, powder compacts, and so on. Fig. 3 shows a machine of this type which uses both abrasive belts and ventilated mops.

4. Rectangular-type Machine

Rectangular-type machines are of the horizontal design, the conveyor line being open in the centre to allow free-standing polishing lathes to be used on both sides of it to reduce the overall length. A typical application for this type of line is for polishing steam iron bodies and articles of intricate shape such as tail-lamp bezels. Fig. 4 shows a combination of the "straight-line" and "over-and-under" type machine specially designed for the high production of bumper bars. The method of handling the work is illustrated diagrammatically in Fig. 5.

The most recent development of the rectangular machine is the universal type. The standard machine has a 44-ft. perimeter, a variable-speed drive

unit in one corner and take-ups in the two opposite corners. Twelve-inch long, cast-iron platens, supported at top, bottom and sides by rollers, are driven by a special drive chain. These platens travel around the side of the machine and have a dovetail mounting surface for the spindle assemblies. Separate motorized roller chain arrangements with back-up guide rails can be placed at any position under the drive chain. This chain engages sprockets on the ends of the spindles and rotates the part for efficient polishing or buffing operations (Fig. 6). This machine can be used both for solids

of revolution and also for intricate shaped articles by means of camming arrangements, a typical example of which is illustrated in Fig. 7.

5. Rotary-conveyor-type Machine

In the rotary machine design a totally enclosed base is employed on which a platen or top table is fixed. This is made in 12 sections and is supported by heavy-duty roller bearings. Large machines up to 31 ft. in diameter have been built and, by totally enclosing the entire machine, many of the dust problems normally associated with polishing can be completely eliminated.

Adjustable Lathes

In conjunction with the machines described above it is normal practice to use floor-standing lathes of special design. These are individually motorized and allow for adjustment in all planes; they can be fitted with spring-loading devices giving a vertical float of up to 9 in. They are normally powered by 5- to 20-h.p. motors and can also be fitted with air-lift devices which enable them to be lifted out of action during the indexing of the components. For the polishing of bumper bars a special lathe has been designed to give a float of up to 12 in. by means of a counter-balancing device. Another modern development is the use of very wide mops and in one or two universal straight-line machines, mops of up to 24 in. wide are now in use. These mops are usually of the ventilated type and can be used either as solid or spaced mops. In the latter case spacers are inserted between the discs to give a very soft cushion mop, thus enabling them to conform even to the most complex shaped articles. These machines have also been designed to give an oscillating movement, as referred to in the description of the sheet polishing machine, so that score marks and polishing lines can be reduced to a minimum.

Semi-automatic Machines

Although automatic polishing machines are undergoing rapid improvement and are becoming increasingly versatile there are, however, certain limitations which should be appreciated when their installation is being considered. In the first place with fully automatic polishing it is not possible to allow for periods of dwell to eliminate particularly large imperfections, such as can be done when manual polishing is carried out. Some form of rectification operation may, therefore, be required at times. Another point is that they may not always be capable of polishing all areas of complex shaped articles without the introduction of a disproportionate number of stages. A certain amount of hand finishing may, therefore, be needed on certain components, but this need not be a major item where the bulk of the polishing is carried out on

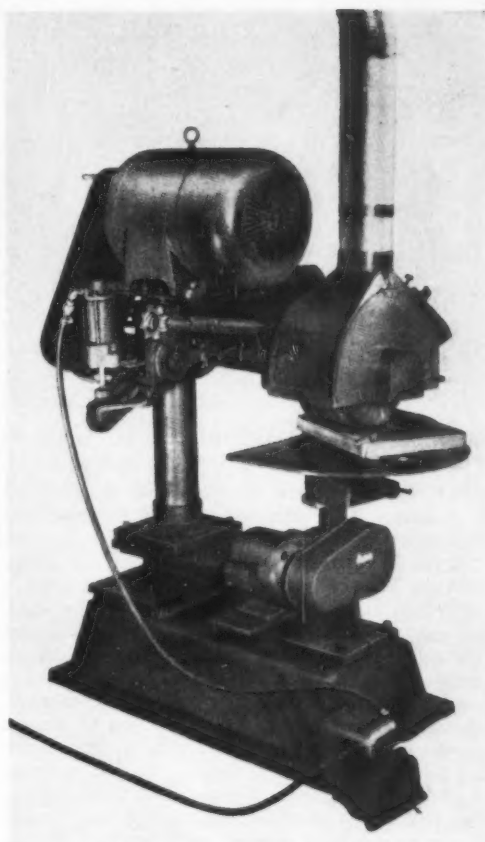


Fig. 9.—Semi-automatic roller-feed unit.

(Courtesy of the Acme Manufacturing Co.)

the automatic plant. These limitations may, however, be reduced by the use of semi-automatic machines where the time of polishing is more closely under the control of the operator of the plant. Semi-automatic machines have been designed to cover all work that can be carried out on fully automatic machines; where the output is limited these semi-automatic machines can be a big factor in the saving of floor space and polishing time. A typical example of a semi-automatic machine is shown in Fig. 8. This is an oscillating machine which can be used with a conventional hand lathe for polishing and buffing out-of-round work such as oval cooking utensils, cake pans, tureens and similar items. The sprocket attachment allows the work to oscillate across the face of the rim, and vertical and horizontal adjustments facilitate quick set-ups.

Another useful machine is what is known as the roller feed unit, shown in Fig. 9, which is also

(Concluded in page 176)

Oil and Colour Chemists' Association

O. C. C. A. Exhibition

HELD during three days in the middle of March, the exhibition once again provided a focal point for new products and new knowledge within the industry. Professor T. P. Hilditch, C.B.E., F.R.S., Emeritus Professor of Industrial Chemistry in the University of Liverpool, performed the opening ceremony on March 17, underlining the emphasis that has been placed on research at this year's show. The first of two instalments, the following pages give a brief account of the stands that were of interest to those concerned in the various aspects of metal finishing.

Allied Colloids (Bradford) Ltd., 11, Great St. Thomas Apostle, Queen Street, London, E.C.4.

OF special interest to the metal finishing industry, this company's stand included the following:

Acronal polyacrylate brands, which in nitro-cellulose lacquers give good adhesion, permanent flexibility, high weather resistance and good light fastness even on light alloys. Plastopal AT and AW which alone, or in combination with alkyds produce stoving enamels with high gloss, very good light fastness and good heat resistance. Plastopal RH, which in the production of stoving alkyds affords good hardness to the alkyd resin and lowers the stoving schedule. It also improves the flow characteristics of epoxy resin formulations. Plastopal BT, a modified UF resin, which is used for producing wash primers, with excellent storage stability and water resistance and good corrosion resistance, before application of the top coat.

Golpanol BH, which when added to pickling acids prevents metal corrosion during the pickling process. It is particularly effective for iron. Emu Powder 120 FD, which is used for producing water-based primer and top coat systems. It affords very good anti-corrosive protection to iron. The Zapon metallised dyestuffs, which are extremely bright and light fast. They are soluble in most solvents and are used in nitrocellulose lacquers and for tinting anodised aluminium.

Associated Lead Manufacturers Ltd., Clements House, 14-18, Gresham Street, London, E.C.2.

THIS exhibit concentrated upon the ability of "Caldiox" calcium plumbate pigmented primers to adhere firmly to new galvanized iron and steel.

Test panels showed the condition of Caldiox calcium plumbate oil-based primers compared with other primers after a three-year weathering test. The test was conducted under very rigorous conditions and the bond of the Caldiox pigmented

primer to the zinc substrate was clearly illustrated. A second series of test panels demonstrated that the ability of Caldiox pigmented primers to bond firmly to zinc is equally applicable when quick-drying vehicles are used in formulating the priming paint.

Experimental demonstrations were given to support the theory that the adhesion of Caldiox pigmented primers to zinc is due to the influence of the Caldiox upon the pH of any moisture penetrating the paint film. Under these conditions, moisture reaching the zinc substrate will not cause the formation of embrittling zinc compounds.

Grouped on the stand were a number of practical examples of the application of Caldiox calcium plumbate pigmented primers, including galvanized sheets, galvanized window frames, gutters, chain-link fencing and door frames. Acknowledgments were made to Henry Hope and Sons Ltd. and Darlington Fencing Co. Ltd. for making available these practical examples from their production lines.

"Caldiox" primers were featured on A.L.M.'s stand



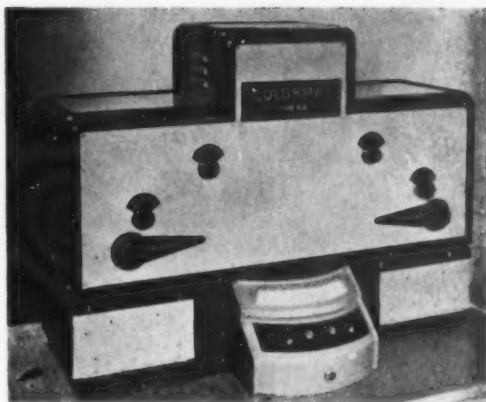
Baldwin Instrument Co. Ltd., Lowfield Street, Dartford, Kent.

THE "Colormat" instrument, designed for the easy comparison of colours of a similar composition, was shown on this stand. It consists of a highly-stable D.C. amplifier fitted with two vacuum-type photocells; the light source has two lamps fitted. One lamp is of the normal tungsten filament type, the other has a mercury-tungsten filament to simulate daylight. Where required, a Zenon-type lamp can also be fitted. Iris diaphragms are fitted for control of the level of illumination. Filters are fitted between the sample and the photocells to enable the complete visible spectrum to be covered in small bands, as well as the relative high bands of the tri-colour series. Three models are available as follows: reflection measurement of static samples; reflection measurement of moving samples, i.e., on a moving web; and transmission measurement of transparent or translucent material, under continuous manufacture.

The basic principal of all these instruments is the same. Light from the source passes via the sample and through the filters to the photocells. If the samples are equal, the reading on the galvanometer will be zero and any deviation from normal will be immediately observed. The instrument can detect a difference in colour of 0.1 per cent between two samples, the makers claim.

In the static model, the sample position consists of a spring-loaded table mounted on the underside of the instrument in a horizontal position to enable samples of any thickness to be measured. Provision is also made for the measurement of powders without using extra attachments. Simple to use, the instrument can be operated by relatively unskilled personnel.

Among the products displayed by F. W. Berk was a chromate introduced by the U.S. National Lead Co.



Baldwin's "Colormat" instrument

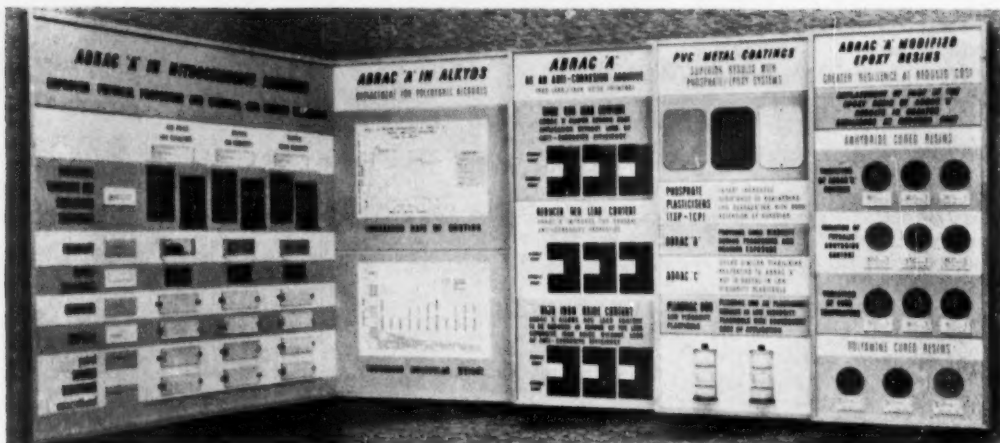
F. W. Berk and Co. Ltd., Berk House, P.O. Box 500, Portman Square, London, W.1.

THREE products of interest to metal finishers were displayed on this stand:—

M.50 : Basic lead silico chromate. The National Lead Co., New York, U.S.A., have introduced a new principle in pigment production whereby the necessary active protective ingredient is chemically and securely bonded to the surface of an inactive core thereby eliminating loss of protective ingredients being buried in the pigment particle. Pigment particle coating permits the use of low specific gravity materials as the inert particle core, producing much higher bulking values than previously, it is claimed, so that the active materials are distributed over a much larger volume. M-50 is such a pigment, and consists of a core of silica, bound chemically by its outside surface with pure basic lead chromate. The makers say that as an anti-corrosive pigment M-50 is outstanding; paints made with it are easy to tint and are claimed to have excellent chalk-resistant qualities giving exceptionally good tint retention.

The **Bentone** range of organic gelling agents continues to find extending application in the surface coatings industry and the benefits from the three available grades were demonstrated. Examples included a bitumen coating containing Bentone 34 which would not flow at any temperature; the ability to apply thick coats without sag; excellent pigment suspension properties at normal and elevated temperatures; and control of sag of epoxy and polyester resins during oven curing.

Ben-a-gel. This organic, soluble and predictable gelling agent for water systems has a number of advantages claimed for it in water-based industrial primers which include viscosity stability, and excellent pigment suspension.



Beck, Koller and Co. (England) Ltd., Beckacite House, Speke, Liverpool 24.

CHIEF exhibit on the company's stand this year was "Beckosol 3020," a short-oil alkyd based upon hydrogenated castor oil and trime thylolpropane (T.M.P.)

As a component of short-oil alkyds, in comparison with glycerol, T.M.P. is claimed to give greatly improved alkali-resistance, and higher gloss in stoving finishes with urea and melamine resins. In Beckosol 3020 these advantages have been incorporated in an alkyd modified with a saturated oil, the colour-retention under heat thus being of a high order. It has also been found that the gloss-retention under heat is better than that of comparable alkyds based on glycerol, the company says.

Another application of this alkyd is in epoxy-resin finishes of the "3-component" type (epoxy-resin alkyd/melamine resin). It gives finishes of high gloss at pigmentations sufficient to ensure good opacity, good colour retention at high stoving temperatures, and much better alkali-resistance than a system containing a glycerol alkyd, it is claimed, and these advantages are obtained without any sacrifice of other desirable properties such as hardness and flexibility. Beckosol 3020 is particularly suitable for domestic appliances and motor cars, and examples of work being done to evaluate it for these uses were shown.

A. Boake, Roberts and Co. Ltd., Carpenters Road, London, E.15.

MAIN theme of the exhibit on this stand was the further advances made in the applications of Abrac 'A' (an epoxidised vegetable oil) in surface coatings. The following items were given prominence.

In nitrocellulose lacquers. The use of Abrac 'A' in conjunction with nitrocellulose and a butylated urea-formaldehyde resin has been shown to give lacquers with improved gloss, solvent resistance and adhesion

Boake, Roberts featured "Abrac" surface coatings

to various substrates. The exhibits on the stand illustrated the advantages claimed for this type of formulation.

Anticorrosive finishes. The use of Abrac 'A' in red lead anticorrosive primers has been shown to minimize the defects caused by the too rapid application of further coats of paint and its presence ensures satisfactory anticorrosive properties under these conditions. These points were illustrated with various test panels.

In alkyds. Attention was drawn to the use of Abrac 'A' in medium and long oil alkyds to give improved gloss and rate of drying. In particular, the shortening of processing times brought about by the use of Abrac 'A' was featured, with special emphasis on its use in alkyd manufacture in conjunction with the cheaper semi-drying oils.

In epoxy resins. Further information was available on the use of Abrac 'A' as a modifying agent for epoxy casting resins, with particular emphasis on its use to produce less costly products.

PVC coated steel. Apart from the above topics, a small section of the exhibit was devoted to the use of Abrac plasticisers and stabilisers in the formulation of PVC compounds for coating steel and showed the advantages to be gained by the use of triethyl phosphate for this purpose.

British Celanese Ltd., Chemical Sales Department, Foleshill, Road Coventry.

THE company demonstrated progress that has been made in the copolymerisation of vinyl acetate monomer with other monomers, one of the main objects being to produce a polymeric material having plasticity. The resultant products are usually referred to as internally plasticised copolymers as opposed to the homopolymers and copolymers made flexible by the addition of external plasticisers.

Among the various groups of comonomers for vinyl acetate which have been studied for this purpose, one of the most interesting is the series of vinyl esters of other fatty acids. These offer the advantage over other comonomers that the physical and chemical properties of the resultant copolymer are unaffected by the ester interchange which may take place on ageing. In addition some of these vinyl esters form homopolymers of considerable interest.

Among the vinyl esters which have been examined are those of the following acids: propionic, butyric, capric, palmitic and stearic, and the company is now able to offer development quantities of vinyl propionate, vinyl caprate and vinyl stearate.

Vinyl propionate is readily polymerised, and the homopolymer is soluble in many organic solvents, including methylene chloride, carbon tetrachloride, benzene, acetone, methanol and ethylene glycol diacetate. The polymer also dissolves on warming in *n*-butanol, xylenes and methyl ethyl ketone, but it is insoluble in ethylene glycol.

As a comonomer with vinyl acetate, vinyl propionate has advantages over such comonomers as dibutyl maleate and dibutyl fumarate in that it polymerises at the same rate as vinyl acetate, and does not, therefore, lengthen the reaction time. It has been found, for example, that a 20-30 vinyl propionate/80-70 vinyl acetate copolymer with a very small proportion (1-5 per cent) of external plasticiser gives paint films of good water-resistance, while a 50-60 vinyl propionate/50-40 vinyl acetate copolymer gives a satisfactory internally plasticised film. Films cast from vinyl propionate homopolymer emulsions tend to be soft, tacky and slightly hazy, though the literature indicates that they have better water-resistance, higher tensile strength and lower temperature of coalescence than those of polyvinyl acetate.

Suggested applications are in adhesives and in films where high water-resistance is required. It is stated that coatings from pigmented polyvinyl propionate emulsion are not readily soiled and have good water-resistance on difficult surfaces such as wood, for example. The literature also indicates that clear films can be obtained from a mixture of polyvinyl propionate emulsion with up to 25-30 per cent unplasticised polyvinyl acetate emulsion and this procedure also improves the surface hardness.

The main use for vinyl caprate is as a comonomer with vinyl acetate; it serves as an effective internal plasticiser in the polymer. Emulsions based on vinyl acetate/vinyl caprate copolymers are of interest for applications where an external plasticiser may tend to migrate or evaporate on ageing, with consequent embrittlement of the film. They are also valuable in cases where compatibility with drying oils is required. Suggested applica-

tions of the copolymers are in emulsion paints for exterior use and wood priming, in adhesives, and in printing inks.

It has been reported that vinyl stearate homopolymers can be prepared by solution, suspension, emulsion and bulk polymerisation. The solid polyvinyl stearate is a hard synthetic wax dispersible in water and is compatible with most waxes, including beeswax. Amongst applications suggested in the literature are: a component in polishes; a component in paper coatings and textile finishes; an agent for increasing the viscosity and depressing the pour-point of lubricating oils; and as a mould release agent.

Vinyl stearate can also be copolymerised with a wide range of monomers such as vinyl acetate, vinyl chloride, styrene, acrylic esters, acrylonitrile, butadiene and maleic anhydride. Vinyl stearate when present in minor proportions in a polymer molecule acts as an internal plasticiser and improves the water-resistance of relatively hydrophilic polymers.

Vinyl chloride/vinyl stearate has a suggested application in metal coatings, and styrene/vinyl stearate in high impact resins for moulding, extrusion, etc.

The stand also illustrated work that has been carried out on the part played by certain water-soluble cellulose ethers in the preparation of P.V.A. emulsion paints. One series of experiments was designed to show the effect on storage viscosity of various fungicides and bactericides while other tests demonstrated the use of S.C.M.C./M.C. mixtures as thickener/protective colloids with particular reference to (a) syneresis, (b) storage viscosity.

British Oxygen Co. Ltd., Bridgewater House, Cleveland Row, London, S.W.1.

THE results of recent development work on the Vandike range of synthetic resin emulsions were shown by British Oxygen Chemicals Ltd. The ease of application of emulsion paints and the appearance of the finished coating depend primarily on three factors—changes in viscosity of the paint during and after brushing, the degree of absorption by the substrate, and the rate of drying of the paint film.

The exhibits illustrated methods developed for examining these three factors and the value of these techniques in the study of the application properties of emulsion paints were shown.

The effect of submitting paints to high shear (colloid mill), and their behaviour after shearing, were illustrated. Graphs showed the effect of shearing on paints and the subsequent rate of recovery of viscosity. The degree of absorption by a porous substrate was determined by spotting the paint, diluted one to one with water on to

filter paper. The radial spread of the paint and aqueous phase could then be observed. The rate of evaporation of water from various paint systems has been studied by casting paint films of standard thickness on polythene. Graphs and figures showed variations that can be obtained with widely differing paint formulations.

British Titan Products Co. Ltd., 10, Stratton Street, London, W.1.

IN view of the great interest aroused by last year's exhibit, the theme of the firm's stand was again "Hiding Power," but confined to flat and semi-gloss paints.

It will be remembered that last year (M.F.J., April, 1958) the effect of various extenders on the opacity of flat oil paints was considered. It was recommended that such paints should be pigmented as near to the critical pigment volume concentration as is consistent with satisfactory brushability, storage stability and enamel hold-out. Only one concentration of titanium dioxide was used with each extender and it was demonstrated that the most economical use of titanium pigments could be made with fine particle size extenders.

In the 1959 exhibit, nine extenders were examined in conjunction with rutile titanium dioxide in flat oil paints and the marked influence of the extender on opacity was again shown. In addition, an attempt was made to determine an optimum level of titanium dioxide for use with each extender with a view to obtaining maximum opacity. Recommendations regarding the most suitable titanium dioxide/extender ratio for each combination were made, and the desirability of pigmenting close to the critical pigment volume concentration was again stressed. The most generally acceptable level seemed to be a pigment volume concentration 5 per cent below the critical level.

As well as these singly extended paints, a number of paints containing combinations of extenders were shown. These had been formulated in order to obtain the most satisfactory colour, low angular sheen, can stability and enamel hold-out while maintaining the opacity as high as possible. The effect on opacity of tinting these paints was shown.

Since the medium has a profound effect on the general properties of a paint, some paints had been prepared with a constant pigmentation but using different media. These had the effect not only of altering the sheen and enamel hold-out but also of changing the cost to a marked degree, and the economics of medium variation were considered.

In another exhibit an introduction to the formulation of high opacity semi-gloss paints was given with a limited range of extenders.

Rex Campbell and Co. Ltd., The Chemical Supply Co. Ltd., 7 Idol Lane, Eastcheap, London, E.C.3.

THE joint stand of these two companies featured a new solvent, Isobutyl acetate 80 per cent and a new plasticiser, Epoxy plasticiser R.C.1. in addition to new data on others. The advantages of using Paraformaldehyde in the manufacture of amino resins were clearly set out, and a number of new cadmium colours designed for use in paints were also displayed.

Not catalogued, but also on view, were the "Arolon" resins manufactured by Archer Daniels Midland Co. as water soluble products intended for industrial stoving finishes. Arolon 304 is recommended by the makers for primers with good water and salt spray resistance, while Arolon 1000 is said to have a performance in gloss enamels equal to a melamine/coconut alkyd system.

Two chemically-treated drying oils with what were claimed to be unique properties were also introduced. Admerol 75 HVA was said to be an ideal medium for aluminium paints; even after storage for one year, these paints showed no loss of brilliance. Varsoy is claimed to be a complete replacement for dehydrated castor oil, giving shorter varnish cooking times.

Carless, Capel and Leonard Ltd., Hope Chemical Works, Hackney Wick, London, E.9.

AS this is the firm's centenary year, a brief outline of their development as a refiner of liquid hydrocarbons over the past 100 years was shown by photographs showing refining plants both old and new illustrating the considerable advances that have been made in the handling and transport of these products.

The rate of growth in the volume of the many types of hydrocarbons refined by the company were shown graphically and, as distinct from their normal production of solvents and diluents for the surface coating industry, prominence was given to the company's development in the chemical field, with special reference to the production of dicyclopentadiene and others of the trimethyl benzenes. The molecular structure of some of these products was illustrated with models.

The company also took advantage of the occasion offered by the exhibition to introduce a new range of aromatic solvents manufactured under the trade name of "Caromax," that extends the Carless range of aromatic hydrocarbons from 80°C. (benzene) up to 230°C. The new additions are at present being made in 10° cuts between roughly 190 and 230°C. Other 10° cuts can be produced to a customer's requirements, and this allied to their freedom from "tail" allows very close control of drying properties in paint formulations. A further advantage of Caromax solvents is their

low sulphur content that makes them specially suitable for stoving finishes. The products are available in commercial quantities, and aromatic content ranges between 80 and 90 per cent.

Ciba (A.R.L.) Ltd., Duxford, Cambs.

THE display on this stand illustrated the properties and applications of the "Araldite" range of epoxy resins for the surface coatings industry. Brief details of the full range of "Araldite" products now available, are given below:—

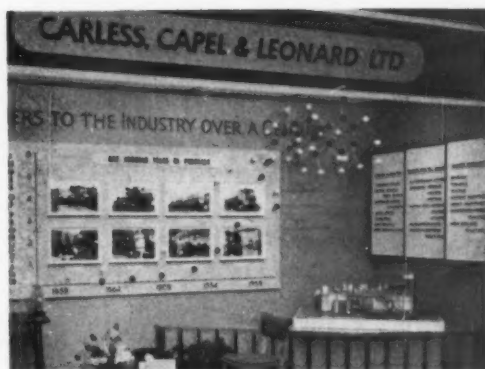
"Araldite" 820-RH. This is a two part formulation, consisting of a resin and a hardener, for cold curing finishes, or, alternatively, for finishes that cure rapidly at elevated temperatures. Coatings based on "Araldite" 820-RH are recommended by the makers when rapidly drying coatings, possessing good chemical resistance, are required. The coatings can be clear or pigmented, as desired, claimed to cure without blushing even at a high relative humidity, and to be free from such surface defects as cissing and pinholing; the cured coatings do not become brittle on ageing. The coatings offer excellent adhesion to metals, wood, ceramics, plastics, plaster and brickwork etc.

"Araldite" 985E and 961A. Both these products are already well established in the surface coatings industry, and the excellent combination of properties possessed by both resins has led to their ready adoption as the basis of stoving finishes in the electrical, food processing, chemical engineering, textile and aircraft industries.

"Araldite" 982AB. There is a tendency to reduce stoving times in continuously-operating ovens by working at higher temperatures, and under these conditions it is essential to employ a finish which is tolerant to a certain latitude in curing conditions. Lacquers based on "Araldite" 982-AB are claimed to have a relatively wide stoving range (i.e., 3-15 minutes at 240°C. or 40-80 minutes at 180°C.). The cured lacquer films are tasteless and odourless and possess excellent resistance to acids, alkalis and solvents. They are recommended by the makers for the internal protection of metal containers, etc.

"Araldite" 880-AB. This product, supplied as two viscous, solvent free solutions, can be used in the preparation of clear or pigmented stoppers which cure in a short time with negligible shrinkage. Adhesion to most materials is so good, it is claimed that priming is unnecessary. Thick films can be applied in one operation.

"Araldite" 6000 Series. The 6000 series provides a range of four basic, solid epoxy resins in order to give paint manufacturers wider scope in formulating their own epoxy finishes. Two of these resins are now available in solution form and are known as "Araldite" 6100/70 and "Araldite" 6300/50.



A century of progress was illustrated by Carless, Capel and Leonard

R. H. Cole and Company Ltd., and Plastic Products Ltd., 2, Caxton Street, London, S.W.1.

THE second-named company exhibited a range of Cellosolve Methacrylate solutions for use in flexible lacquers for rubber and PVC. Solvents were carefully selected for each purpose and finishes developed were of interest to specialists engaged in the toy and model trades. Special PVA emulsions for gloss coats with excellent qualities of adhesion, flexibility and freedom from tack had particular application for linoleum finishes, together with PVA emulsions for use as bitumen sealers. Since last exhibiting, work has continued on PVA emulsions for both interior and exterior emulsion paint, and the production of emulsions combining good gloss and brushing properties.

In addition to the materials mentioned, R. H. Cole and Co. Ltd. displayed the latest developments in BX terpene resins manufactured in this country at Manningtree by BX Plastics Ltd.

Petroleum, substituted styrene and other resins for metallic paint media, textile finishing, paper coatings, heat seal and hot melt adhesives were exhibited. The new "Steatite" laboratory pot mill with a release lid was shown, and latest developments in the production of high density Steatite mill balls and mill lining blocks were also on view. Exhibits included high-quality grades of coumarone-indene resins and latest developments in Thermochrom and Thermocolor temperature indicating crayons and colours.

Cyanamid of G.B. Ltd., General Chemicals Division, Bush House, Aldwych, London, W.C.2.

EXHIBITING for the first time at this exhibition, the company showed some products which although fairly new to this country are already well-known in the United States.

The products were grouped under the headings



Well-known U.S. products that are fairly new to this country were shown by Cyanamid of G.B.

of monomers, polymers, catalysts and curing agents, additives and a corrosion inhibitor.

Monomers. Shown under this heading were such basic raw materials as acrylonitrile, acrylamide, diallylamine, and methylene-bis-acrylamide. These new monomers give opportunities for copolymers having pre-determined properties to be designed.

Polymers. Under this heading were resins and emulsions with recommended formulations for modern finishes. Many types of surface coatings were catered for in a range including Cyacua and Cyzac resins.

Catalysts and curing agents for epoxy resins. Substituted amines and melamine derivatives gave improved properties to these versatile resins.

Additives. Various new additives for special purpose paints and lacquers are now available from the company. Also on view here was Polyacrylamide, a water soluble thickener and emulsion stabilizer.

Corrosion inhibitor. Guanylurea phosphate for the prevention of rust on tin plate was demonstrated.

The Distillers Co. Ltd., Chemical Division, Devonshire House, Mayfair Place, Piccadilly, London, W.1.

THE main item in the display here of interest to metal finishers concerned the vinyl chloride/vinyl acetate copolymer resins. Comparative data on a range of solvents and plasticisers with such resins was displayed.

The materials are used as surface coatings on metal, and lined beer cans and food tins, together with other examples such as cocoon packaging and strippable protective coatings of metal parts, were shown.

Elga Products Ltd., Railway Place, London, S.W.19.

THIS company featured their Mark II version of the "Elgastat" Major, equipment that is now widely used in academic and industrial research establishments for producing deionised water. Improvements incorporated in the Mark II include making all exposed components in corrosion resistant plastic. Improved flow rates give equilibrium water (4 megohms/cm⁺) at up to 10 gal. per hr. and distilled quality water at up to 20 gal. per hr.

Two versions are available. Where the requirements are for commercial grade distilled water, a capacity and exhaustion indicator is indicated (type B.104). For critical applications, a conductivity monitor forms an integral part of the unit, and gives an accurate quality check throughout the exhaustion cycle (type B.104, CON). A standard modification makes it possible to pipe deionised water to any number of draw-off points. In common with the other Elgastat models, no regeneration in situ is necessary. The company operates a cartridge supply service.

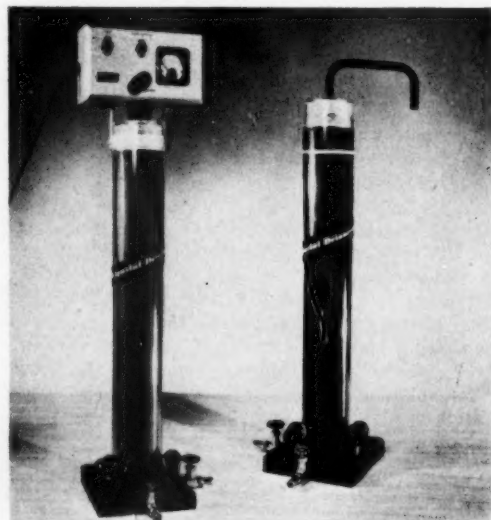
The unit was used at the exhibition to demonstrate the feeding of deionised water to weatherometers.

Leon Frenkel Ltd., Pomeroy House, 28a Basinghall Street, London, E.C.2.

DETAILS of developments available about the company's products here included:

Alkyd resins: a range of qualities now in production. **Aluminium alcoholate:** development in the

Elga's deionised water plant.



use of "Ennogela" in heat resistant aluminium paint. *Alcohol soluble resins*: additions to the range. *Fatty acids*: both saturated and unsaturated produced with a high degree of purity for the paint industry by the Littleborough plant of Hess Products Ltd. *Pentaerythritol*: developments at the Lancashire plant of Walker Extract and Chemical Co. Ltd.

The Geigy Co. Ltd., Rhodes, Middleton, Manchester.

THE outstanding features of the Geigy phthalocyanine blues—their excellent texture and ease of dispersion—were claimed to be a new development in this field. The exhibit illustrated these, drawing special attention to the brilliant shade and non-flocculating properties of Irgalite Fast Brilliant Blue GLS. This very pure phthalocyanine blue was also illustrated in four-colour printing processes.

An entirely new range of pigment dispersions for the simple coloration of aqueous flexographic inks was introduced under the designation Irgalite SGP colours, to make available to the flexographic ink maker brilliant shades not easily obtainable with existing pigment powders.

Work has continued on the production of easily dispersible pigments for flexographic and gravure inks, and the latest developments of toners were displayed.

The exhibit also illustrated the results of new work on the special requirements of paint formulators in relation to high temperature stoving and chemical resistance; and new additions to the Irgalite SPV range of aqueous pigment dispersions for emulsion paints.

Gilbarco Ltd., 740 High Road, Tottenham, London, N.17.

THE Brodie-Kent meters for the automatic control of all solvents and media were on show on this stand. The meters, equipped with presetting counters and valves, are eminently suitable for all batching operations.

The company claims that under consistent operating conditions accuracy of the order of ± 0.1 per cent is achieved; and since these instruments feature a built-in adjustment mechanism, calibration to within very fine limits can be effected. In addition, auxiliary equipment in the form of strainers, air eliminators, flow control valves, etc. were also shown. For certain work, meters to copper-free and non-ferrous specification can be supplied. Remote control equipment to operate in conjunction with Brodie-Kent Meters is also available.

Price's (Bromborough) Ltd., Bromborough Pool, New Ferry, Nr. Birkenhead, Cheshire.

THIS company manufactures a complete range of stearines and oleines including those used in the manufacture of buffing compositions, in the rolling of aluminium foil and the pressing of aluminium sheet, in the production of metal pigments, and in the manufacture of sintered metals. The products exhibited included the following:

Buffing compositions, which are dispersions of abrasive in a lubricant matrix, are most commonly in the form of solid blocks, and stearines from the "Pristerene" range, especially Nos. 60, 61, 62, 63 and 64 are suited to these products. In more recent years, the development of liquid compositions which contain emulsified water has admitted the "Priolene" brand oleines into this field.

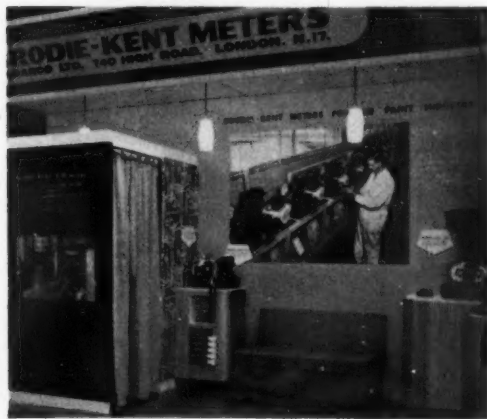
In foil rolling, Priolene 75, applied in kerosene or white spirit solution, has proved most satisfactory in the final stage, say the makers, who claim it provides excellent lubrication under pressure and friction.

Pristerene 67 is used in white spirit solution as a lubricant in the pressing of articles from aluminium sheet. In the production of metal pigment (e.g. aluminium and bronze) pastes and powders for surface coatings, etc., Pristerene 63 is employed as a lubricant and polishing agent. The well-known leafing effect in aluminium paints is due to the presence of a film of stearine on the particle surfaces.

Stearine powder of small particle size is used in the preliminary pressing stages in the production of sintered metal components. Here the lubricant properties of stearine are utilised to facilitate removal of green compacts from the dies. In liquid metal polishes, use is made of the ammonia soaps of oleines to suspend the polishing agents in the dispersing fluid.

(To be concluded)

Gilbarco exhibited "Brodie-Kent" meters.



Advantages of

POTASSIUM STANNATE

*in
electro plating and
immersion plating*

The economic advantages of using potassium stannate are very considerable.

Probably the best known application in immersion plating is the tinning of aluminium pistons. By using potassium stannate instead of sodium stannate it is possible to achieve substantial reductions of sludge formation together with much improved analytical control limits. Plating baths can be operated continuously and far less time is spent by operatives in the control and maintenance of the bath.

In electroplating, solutions containing potassium stannate have a far greater electrical conductivity than similar solutions containing the same concentration of sodium stannate. This means that higher current densities are obtained for a given voltage. Conditions are ideal for barrel plating. Alternatively a dilute potassium stannate solution can give the same plating rate as a more concentrated one containing sodium stannate, so that wastage by drag-out, and initial costs are reduced considerably.

Using *High-Speed* tin anodes, it is possible to reduce substantially the number of anodes in the vat. This is particularly useful in the many cases where a small bath is being overloaded with work. "Filming" difficulties are virtually non-existent.

Write for data sheets and full information on these products to

Metal Finishing Department
ALBRIGHT & WILSON (MFG) LTD
1 Knightsbridge Green, London SW1
Telephone: KENsington 3422

Visit Stand No. 3,
Outer Row Gallery, Grand Hall,
Engineering, Marine, Welding and
Nuclear Energy Exhibition
at Olympia
April 16th-30th

FINISHING

NEWS REVIEW

SYMPOSIUM ON
PLANT DESIGN

A JOINT Symposium on Instrumentation and Computation in Process Development and Plant Design will be held at the Central Hall, Westminster, London, S.W.1., on May 11-13.

The symposium has been organised by The Institution of Chemical Engineers, The Society of Instrument Technology and The British Computer Society, under the aegis of the British Conference on Automation and Computation. Further information can be obtained from The Institution of Chemical Engineers, 16, Belgrave Square, London, S.W.1.

S.C.I. 2-YR. AWARD
TO DR. CARR

THE society medal of the Society of Chemical Industry, awarded not more than once every two years for conspicuous services to applied chemistry or to the Society, has been awarded for 1959 to Dr. Francis H. Carr, C.B.E.

TIN INSTITUTE'S
REPORT TELLS OF
NEW ADVANCES

THE annual report on the work of the Tin Research Institute published recently mentions many newly discovered facts about tin, its alloys, and chemical compounds that could be worth careful study by industry.

Electrical industries will be interested in work on solderability of various coatings on metals, and the packaging industries will take note that methods for improving the quality of tinplate continue to be investigated and the significance of porosity in tin coatings is being studied by new methods.

Metal industries will find many items of interest including the work on new alloys of tin with "newer" metals such as titanium. Tin-nickel plating is now being taken up by watch and instrument industries for which this plating has much to commend it.

A.E.S. DETROIT CONFERENCE

Complete Programme for June Event Issued

The complete tentative programme for the fifth international conference of the American Electroplaters Society to be held in Detroit from June 14 to 19 has recently been issued.

The conference will be the educational portion of the Golden Jubilee Convention of the Society, and a large and comprehensive industrial finishing exposition is to be held in conjunction with it. Some of the titles of papers are given below.

"Experimental Studies of the Electrodeposition of Metals in Narrow Crevices," Dr. Henry Leidheiser, Jr., and Mrs. Lucille B. Garmon.

"A Black Chromium Plating Process," Dr. A. K. Graham.

"Levelling Power of Copper Sulphate Baths with Complexing Addition Agents," Prof. Eugenio Bertorelle, Dr. I. R. Bellobono and Dr. A. Scarati.

"Plating Zinc on Steel from Pyrophosphate Solution A Pilot Plant Investigation," U. F. Marx and D. Povey.

"Electrodeposition of Nickel Alloys from the Pyrophosphate Bath," Dr. T. L. Rama Char.

"The Influence of the Physical Metallurgy and Mechanical Processing of the Basis Metal on Electro-

plating — Ferrous Metal Conditions Affecting the Durability of Watts Nickel Deposits," Dr. M. H. Jones, and Chih-Yeu Lu, A. F. Mohnheim J. Zajdowski.

"Experiences with the Use of the Accelerated Acetic Acid Salt Spray Test," C. F. Nixon.

"Some Aspects of the Corrosion of Decorative Plated Coatings," F. A. Lowenheim and W. H. Rowan.

"European Bright Anodizing Practice," A. W. Brace.

"Anodizing Processes For The Production Of Very Thick Alumina Films," R. Segond, P. Lelong, J. Herenguel.

"Some Chemical Polishing Processes — Their Mechanism and their Application," Dr. H. Spahn.

"Protecting Silver and Copper Against Tarnishing by Means of a Chromate Passivating Process," Dr. P. Baeyens and J. L. Melse.

"Barrel Plating with Special Consideration to Protection of Thread Diameters," A. W. Wallbank.

"Ductility in Plated Coatings," Dr. H. J. Read.

OFFICIAL OPENING OF V.E.D.C. LONDON OFFICE

ON March 11 a reception was held to mark the official opening of the new London office of the Vitreous Enamel Development Council at 28, Welbeck Street, W.1. Welcoming the guests were Mr. R. W. Holmes, deputizing for Mr. S. W. Vickery, chairman of the Council, who was unable to be present owing to his absence abroad, and Mr. K. G. Jones, the recently appointed general manager of the Council. Representatives of many other members of the Council were also present.

In a short address to the guests Mr. Jones said that since the formation of the Vitreous Enamel Development Council just over two years ago it had been successful in laying down minimum manufacturing standards among its mem-

bers. The maintenance of enamel quality, a matter of vital importance in promoting wider use of the finish, was a matter of very great concern to the Council, who had been at pains to inform and educate the consuming public concerning the nature and properties of the enamel finish.

Mr. Jones referred to the Enamel Advisory Service which had been started in London for the benefit of housewives and industrialists to deal with the many problems encountered with regard to enamel finishes on domestic and industrial products. This service has been extended so that advisory bureaux existed in Birmingham, Cardiff, Glasgow, Manchester and Newcastle, and it was hoped to introduce further centres later in the year.



ELECTRODEPOSITION CENTRE

Canning's Improved Service in Birmingham

THE opening of a new technical centre by W. Canning and Co. Ltd., Great Hampton Street, Birmingham 18, offers increased facilities for research and development in electrodeposition and it is hoped will still further improve the efficiency of technical service to customers in the electroplating and metal finishing trades.

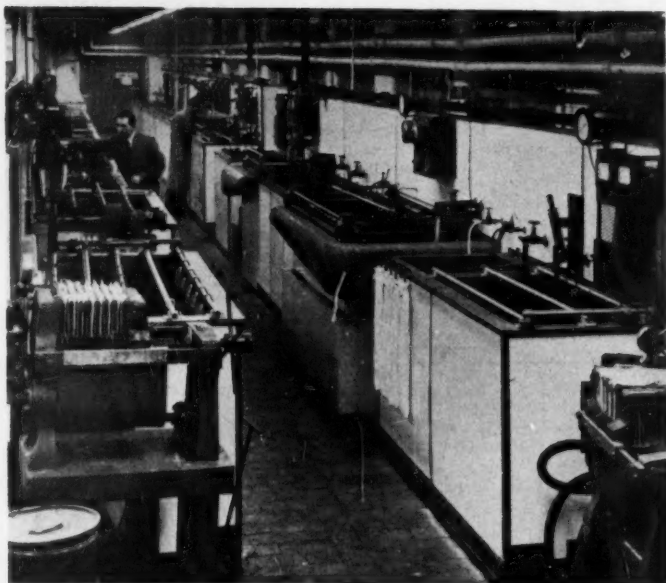
Plans for expansion were laid by the company some years ago to develop a centre in which the different laboratories could be housed together under one roof with their associated services. It was not until 1956, however, that suitable premises could be obtained. The aim has now been achieved and the various analytical, metallurgical, service and lacquer laboratories assembled together with a fully equipped plating department for demonstration and research purposes.

The main plating shop is situated on the ground floor with the tanks arranged in two parallel rows, barrel plating equipment with separate rectifier control being adjacent, as also the polishing room and barrel finishing sections. In accordance with modern practice, fume extraction has been provided by exhaust ducting from the lip of the tanks, the ducting being carried downward and connected to main trunking under the flooring of the shop. The tanks and controls are cased in plastic, the tops of the tanks having a common level, the whole appearance and design of the plating shop being both modern and clean, providing ideal working conditions.

This modern equipped plating shop will provide increased facilities for training and demonstration purposes but has been designed principally with a view to fulfilling the needs of an ever expanding research programme.

The main laboratories are housed on the first floor, together with the executive offices and service chemists department. Again, entirely new equipment has been provided and an instrument room furnished with the latest research apparatus. Separate lacquer laboratories have been provided for lacquer development. On the top floor there is a lecture theatre which will seat over 70 people. This is equipped with a 16 mm projector and sound equipment.

Mention should also be made of the ever increasing research work that is being carried out to meet the needs of modern polishing processes, and investigation of new techniques.



(Above) Part of the demonstration plating shop, and (below) a section of the general analytical laboratory.

BIRLEC'S H-T SERVICES DIVISION

Aldridge Plant Includes Finishing Processes

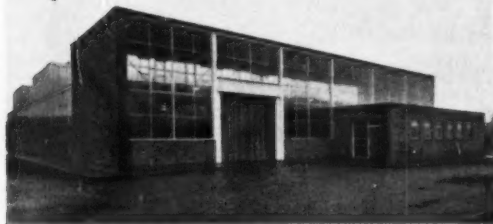
A HEAT treatment division of Birlec Ltd., has been formed to provide a contract heat treatment service to industry, and to demonstrate a selection of standard Birlec heat treatment furnaces under normal operating conditions. The company's extensive and modern works at Aldridge provide capacity for bright annealing and normalising; clean hardening and tempering; nitriding; carburising and carbonitriding; low temperature treatments and furnace brazing. Capacity is also available for degreasing, copper plating and descaling complementary to these processes.

The facilities for bright annealing and normalising, used for a number of years at the old heat treatment works at 95, Tyburn Road, Birmingham, have been substantially increased. Capacity is available for

Up to 20 ton per week of bright hardening work can be carried out at Aldridge in Birlec shaker hearth furnaces and sealed quench furnaces. A protective atmosphere of neutral endothermic gas to avoid scaling and decarburisation is employed for the process.

Tempering capacity is available in vertical forced air circulation furnaces having charge spaces of 26-in. dia. x 24-in. deep. A muffle type batch furnace with internal dimensions 48-in. long x 30-in. wide x 12-in. high, is available for hardening requirements. To prevent scaling and decarburisation of the charge, a protective atmosphere can be supplied to the furnaces.

For processing up to 10 ton per week of carburising and carbonitriding work, Birlec sealed quench furnaces are available, with a limiting



(Above) Exterior view of the new Birlec heat treatment division at Westgate, Aldridge.

(Right) Copper plating facilities are available for application prior to brazing, for stopping-off carburising, and for general plating.

processing upwards of 40 ton per week of bright annealing and normalising, carried out in mesh belt conveyor furnaces. Whereas a protective atmosphere of burnt town-gas (exothermic gas) is most commonly employed within the furnace, endothermic gas may be preferred for the treatment of medium or high carbon steels.

Dependent upon the nature of the components, furnace brazing can be carried out in either mesh belt or batch-type furnaces at Aldridge. Backed by the accumulated experience of copper brazing gained at "95" over a number of years, capacity is available for copper brazing mild steel or medium carbon steel assemblies, and also for furnace brazing using silver solders or other brazing alloys.

size of 24-in. long x 15-in. wide x 12-in. high. Pack carburising capacity is also available for processing pieces up to 30-in. square x 12-in. high. For the localised case hardening of small batches, uneconomical to process in the sealed quench furnaces, a small cyanide salt bath is available.

Stress relief annealing, solution treatment, ageing, and other low temperature heat treatment processes can be carried out in vertical forced air circulation furnaces having a charge space of 26-in. dia. x 24-in. deep. A water quench tank is available for quenching work from these furnaces.

To supplement these services, equipment has been installed for a number of ancillary processes that include: descaling by pickling or shot blasting; copper plating for stopping-off carburising or applying copper prior to brazing and degreasing either by trichlorethylene or alkali wash, a valuable service to customers without degreasing facilities.



OPEN DAYS AT W.P.R. LABORATORIES

THE Water Pollution Research Laboratory will be holding its first open days on May 6 and 7, when the work of the laboratory will be on view to those interested in the treatment of sewage and industrial waste waters and the control of pollution of natural waters.

Applications for invitations to visit the laboratories on one or other of these days should be sent to the Director not later than April 30. The address is Elder Way, Stevenage.



Shell-B.P. Plant for N. Ireland

LORD Glentoran, Northern Ireland Minister of Commerce, announced in the Northern Ireland Parliament recently that Shell-Mex and B.P. Ltd. are to construct and operate a refinery in Northern Ireland subject to satisfactory conditions being negotiated. Londonderry will be given the closest consideration as a possible site, but it will be three or four years before the refinery could come into operation.

Hanovia Make it

THE mercury lamp mentioned on page 81 of the February issue of this journal is manufactured by the Hanovia Lamps Division of Engelhard Industries Ltd., at Slough, Bucks.



ALBRIGHT & WILSON SUB'S EXPANSION

DR. David E. Jones, president of the Electric Reduction Company of Canada Ltd., one of the major Canadian producers of phosphorus and phosphates, and one of the Albright and Wilson group of companies, recently announced that ERCO is to expand and diversify its production facilities. The multi-million dollar plans include new plants to produce sulphuric and phosphoric acids, as well as sodium phosphates and other products, mainly for use in Eastern Canada. The new plants are to be at Port Maitland in Ontario.

Engineering of the project has already been completed; construction will start almost immediately and production should begin early in 1960. S. W. Ontario is one of the major markets in Canada for the high analysis fertilisers made from phosphoric acid, until now imported from outside Canada, and phosphates are an important raw material for the detergent industry as well as for metal finishing and food processing. All these industries are concentrated in Central Ontario, so that Port Maitland, sited at the point where Grand River enters Lake Erie, and possessing excellent rail, road and deep water transportation facilities, is an ideal centre for the new plants.

The company's recent expansion of sodium chlorate production in Buckingham (Quebec Province) and in Vancouver (British Columbia) is claimed to make ERCO the largest producer of sodium chlorate in the western world.

HERBERT MORRIS TAKE OVER MonoRail

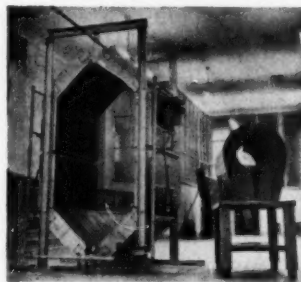
THE British and American shares of British MonoRail Ltd., Wakefield Road, Brighouse, Yorks., have been acquired by Herbert Morris Ltd., of Loughborough.

British MonoRail Ltd. specialise in the design and manufacture of ultra-modern overhead handling equipment, including some of the most highly-developed underslung cranes available in Great Britain. Under the new arrangement, the company hopes to be able to finance

GAS FOR INDUSTRIAL PLANT

Southern Board Open Centre at Poole

A well-equipped industrial development centre has just been opened at Poole, Dorset, by the Southern Gas Board. At their old Bourne Valley works, the Board have converted part of a disused retort house into a small but comprehensive industrial showroom and workshop. The displayed range of industrial gas-fired equipment can be demonstrated under simulated factory conditions, and used to carry out tests on customers' own products.



Radiant heat drying tunnel

A variety of burner equipment and systems for automatic ignition and control can also be shown in operation. Gas and air at both high and low pressures are on tap throughout the centre.

The workshop undertakes experimental work and the design and

construction of prototype plants for a customer, if necessary. Most of the work undertaken arises from problems sent in to the industrial development engineer in charge by the Board's five regional industrial engineers—based on Bournemouth, Oxford, Portsmouth, Reading and Southampton—but some is in the form of development work on new projects which may eventually benefit many customers.

Already, since work began at the centre, a number of projects of considerable help to industrial customers have been completed on the premises, the Gas Council says. These include the construction of a furnace for the testing of refractories up to a temperature of 1,550° C., the design of a conversion for a core drying stove, and experimental work to find the most suitable heat treatment schedule for the brass components of a domestic appliance. Work at present on the floor includes an installation for the prevention of fume nuisance from the exhaust system of an oil-fired drying oven and the re-design for the manufacturer of the combustion system of a range of hospital sterilizers.

That gas can provide good economic heating for a wide variety of conditions is illustrated by a full range of overhead radiant heaters, and a selection of central heating and hot water boilers. The heating of the showroom and workshop is by systems of ducted hot air and radiant heating.

APPLICATIONS INVITED FOR MOND AWARDS

THE Mond Nickel Fellowships Committee is inviting applications for the award of Fellowships for 1959. The main object of these Fellowships is to enable selected applicants of British nationality and educated to University degree or equivalent standard to obtain additional training and wider experience in industrial establishments, at home or abroad, so that if they are sub-

sequently employed in executive or administrative positions in the British Metallurgical Industries, they will be better qualified to appreciate the technological significance of research and to apply its results.

There are no age limits, though awards will seldom be made to persons over 35 years of age. Each Fellowship will occupy one full working year. It is hoped to award five Fellowships each year of an approximate value of £900 to £1,200 each.

Applicants will be required to define the programme of training in respect of which they are applying for an award, as well as particulars of their education, qualifications and previous career. Full particulars and forms of application can be obtained from The Secretary, Mond Nickel Fellowships Committee, 4 Grosvenor Gardens, London, S.W.1.

Completed application forms should reach the Secretary of the Committee, not later than June 1.

TECHNICAL and INDUSTRIAL APPOINTMENTS

Mr. B. T. Scott, until recently sales engineer with Kestner Evaporator and Engineering Co. Ltd., has now joined **Miles Structural Plastics Ltd.**, as sales development engineer. Miles are currently expanding their production capacity in both the asbestos phenolic and glass-fibre fields.

Mr. J. G. Marsden, until recently with British Paints Ltd., of Newcastle-on-Tyne, has joined **Anti-Dust Services Ltd.**, as general sales manager in charge of U.K. sales.



F. A. Field
Black and Decker

The appointment of Mr. F. A. Field as industrial contracts manager was announced recently by **Black & Decker Ltd.**, Harmondsworth, Mddx.

Mr. Field has had very wide experience in the electric tool industry. In 1933 he joined Bosch Ltd., as sales promotion manager and was responsible for the U.K. sales of products manufactured by Robert Bosch A.G. of Stuttgart. He joined Black and Decker in 1939 as district manager, Leeds, subsequently being appointed U.K. sales manager with particular emphasis on industrial and automotive products. In 1957 he left Black and Decker to join the Eutectic Welding Alloy Co. Ltd., as managing director, an office he has recently relinquished.

Mr. Leslie J. Cox, M.I.P.R. has been appointed chief of the P.R. department of **Wolf Electrical Ltd.** He will also cover press relations market research (home), employee relations, sales training, and education. Mr. Cox is a long standing member of the Institute of Public Relations. He joined Wolf's thirteen years ago and has served successively as manager to the export, home sales and publicity departments.

A new post, that of technical liaison officer, has been given to Mr. Edward Patterson, M.I.B.E., M.S. I.A. In addition to internal technical committee work, he will represent the company on all British and international technical committees. Mr. Patterson will also be responsible for the production of instruction folders and the handling of technical queries, new ideas, etc. He joined Wolf's in 1956 as technical and market research adviser, having previously been technical director to Domestic Engineering Ltd. Earlier, he was with E.M.I.

Mr. Alan Price until recently with John Preston and Co. Ltd., has joined the sales staff of **Newton Plating Jigs and Insulations Ltd.**, as an additional Midland representative.



V.E.D.C. APPOINT NEWCASTLE AGENTS

THE Vitreous Enamel Development Council have announced that J. M. and J. Bartlett Ltd., 10-14, Princess Street, Newcastle-on-Tyne, have been appointed to operate the enamel advisory service—a free information service for housewives—in the northern area.

Enquiries from the public or companies in the Newcastle area will be answered over the telephone where possible, or at the showrooms in Princess Street. All technical enquiries will be dealt with by letter.

Summers Show Their Staff



ONE recent work's exhibition of a firm's products that created a great deal of enthusiasm among employees was that covering the development and application of "Stelvetite" the plastic-coated steel sheet, at the Hawarden Bridge Steelworks of the makers, John Summers and Sons Ltd., Shotton, Chester. In the first week, 2,000 employees and their wives and families visited the exhibition. When the Stelvetite exhibition was held at the Royal Festival Hall, London, in January, more than 1,600 representatives of industry attended.

The recent display at John

Summers' works was not so large as at the Festival Hall, but many of the same exhibits were shown so that employees—from furnace men to those employed on the Stelvetite bonding process—might see some of the articles that resulted from their efforts.

Panels showing the different ways Stelvetite can be worked and actual examples of some of the finished products were on show. These included a lift door, partitioning, office furniture, fume ducting and roofing. Smaller pressings of Stelvetite were also displayed and there were many photographs of its uses.



U.S.S.R. CORROSION PAPERS LISTED

Dr. E. C. Potter and Mr. J. B. Cotton represented the Corrosion Group at the U.S.S.R. Corrosion Congress last year. They have prepared a list in English, of the titles of the 200 papers presented to the Congress and a copy of this list will be supplied to members of the Group who make application for it to the Assistant Secretary, Society of Chemical Industry, 14, Belgrave Square, London, S.W.1.

A limited number of copies of summaries of some of the papers, in Russian, can also be made available to those who would find them useful and members may make application for these after they have seen the titles.

NEW COMPANIES

"Ltd" is understood, also "Private Co."

Figures = Capital, Names = Directors, all unless otherwise indicated.

A. R. Knowlson, Howard Works, Broad Street, Sheffield. February 24. £2,000. To take over bus. of electro platers carried on as "A. R. Knowlson & Co." at 26, Eyre Lane, Sheffield, etc. **Albert R. Knowlson**, Mrs. E. Knowlson.

Dundex, 25, Chesham Road, Amersham. February 24. £100. To carry on bus. of importers, exporters, manufacturers, wholesalers, retailers or agents for adhesives of all kinds, etc. **Francis W. E. King**, **Joyce M. Tack**.

E. Thorn & Sons, 63, Mott Street, Hockley, Birmingham. February 27. £10,000. To acquire part of the bus. of metal finishers carried on by E. Thorn and Sons Ltd. **Thos. E. Thorley**, **Richard Carless**, **Dorothy A. Carless**.

Osmor Transformers, 11, New Court, Lincoln's Inn, W.C.2. February 27. £100. To carry on bus. of designers, manufacturers of and

dealers in electrical transformers and voltage regulating equipment, etc. **Louis Kanner**, **Alexander C. Kanner**, **Alfred V. Lake**.

D. J. Badman, 21, Stone Street, Gravesend, Kent. March 5. £4,000. To carry on bus. of manufacturers of and dealers in dynamo armatures, magnetos, etc. **Donald J. Badman**, **Mrs. Dorothy E. F. Badman**.

Airless Spray Hire, 5, St. James's Place, S.W.1. March 6. £100. To carry on bus. of hirers and letters of hire of airless spraying equipment, etc. **Thomas Cowlard**, **Reginald B. Moss**, **Jack Mayhew-Sanders**.

Winthrop Arzneimittel G.m.b.H. Neville House, Eden Street, Kingston on Thames, Surrey. March 6. 20,000 Deutsch Marks. Registered in Western Germany in 1958, to manufacture and sell chemical products, etc. Names of person authorized to accept service: **Noel J. Horn**.

From the Register compiled by Jordan & Sons Ltd, 16 Chancery Lane, London, W.C.2.

MEETINGS OF THE MONTH

April 17

Plastics Institute (Midlands Section). "Development of Fire and Heat Resistant Materials," by **W. Wilson**, at the James Watt Institute, Great Charles Street, Birmingham. 6.30 p.m.

April 24

Institute of Vitreous Enamellers (Southern Section). Social Evening. Dinner at Kettner's Restaurant followed by a visit to Cinerama.

April 28

Institution of Chemical Engineers. Annual General Meeting and Dinner, at the Park Lane Hotel, London, W.1.

Institute of Vitreous Enamellers (Scottish Section). Works visit to the British Aluminium Co. Ltd.

April 29

Institution of Mechanical Engineers (Ind. Admin. and Eng. Prodn. Group). "Industrial Finishing," discussion at 1, Birdcage Walk, London, S.W.1. 6 p.m.

May 1

Leeds Metallurgical Society. "Chromising," by **Dr. M. L. Becker** (The Chrome-Alloying Co. Ltd., Hatfield), in Lecture Room C of the Chemistry Wing, The University, Leeds. 7.30 p.m.

Chemical Society and Birmingham University Chemical

Society (Joint Meeting). "The Structure and Reactivity of Reduced Metallic Surfaces," by **K. W. Sykes**, at the Chemistry Dept., University, Edgbaston. 4.30 p.m.

May 6

Society of Chemical Industry (Corrosion Group). Annual General Meeting. 6.30 p.m.

May 7

Birmingham Paint, Varnish and Lacquer Club. "The Chemical and Electrochemical Production of Surfaces that are to be Plated," by **J. N. Hitchin**, (W. Canning and Co. Ltd.), at the Imperial Hotel, Temple Street, Birmingham. 7.50 p.m.

Newton Directors Visit U.S. Firms

THE directors of Newton Plating Jigs and Insulations Ltd., 13, Strafford Road, London, W.3., are to visit the works of two of the largest electroplating jig manufacturers in the United States during their visit to the country to attend the International Metal Finishing Conference to be held in Detroit, Michigan, next June. The firms are the **Belke Mfg. Co.**, of Chicago, and the **Davies Supply and Mfg. Co.**, St. Louis.

METAL FINISHERS IN SLOUGH ENGINEERING SHOW

THE West London and Thames Valley groups of the Engineering Industries Association gave a trade exhibition last month at the Adelphi Cinema in Slough, Bucks. The Mayor of Slough, Alderman **Mrs. M. J. Morgan**, performed the official opening on March 10, and in her speech of welcome to the exhibitors spoke of the importance of engineering to the town. Although it was more than ten years' since the E.I.A. last held an exhibition in Slough, it was hoped that in future they would occur more frequently. The next was scheduled to take place in 1961. **Mrs. Morgan** also outlined the activities of the association, and said that there were now more than a hundred firms in each of the two groups taking part in the exhibition.

The display was arranged in the dance hall of the cinema, and covered a wide range of engineering products made by member companies. In the metal finishing field, **John Warrick and Co. Ltd.**, **Atlas Plating Works Ltd.**, and the **Isleworth Metal Polishing and Plating Co. Ltd.**, all had stands displaying examples of the work their companies do.

"KNOW-HOW" OF MANUAL LIFTING

I.W.S. Organise 5-day Course at Eastbourne

INTEREST in the application of correct manual lifting and handling techniques to avoid injury and to reduce physical effort has increased in recent years to the point at which there is a growing demand for instruction within industrial firms.

A five day residential course designed to equip employees to instruct their colleagues in kinetic methods of manual lifting and handling has been organised by the Industrial Welfare Society, in association with the Central Council of Physical Recreation, and will

be held at Victoria Court, Eastbourne, from April 20-24.

A survey of the need for improved operator training techniques will be presented by Mr. W. Douglas Seymour of the department of engineering production, Birmingham University, at a two-day course for works managers organised by the Society. The course will be held at the Hotel Rembrandt, Thurloe Place, London, S.W.7., on April 29 and 30.

Mr. William Durham, I.W.S. assistant director, will evaluate the statistics and other information that the works manager can expect to obtain from the personnel department, and Dr. Denis E. Wheeler, B.Sc., Ph.D., F.R.I.C., managing director of the Wellcome Foundation Ltd., will examine various management structures. Practical problems of wage administration will be discussed by Mr. D. L. Davies, I.W.S. technical adviser, and Mr. R. A. Shepherd, suggestion schemes officer of the Ford Motor Co. Ltd., will speak on the basis for success in suggestion schemes. Delegates will also attend a "New Thinking" luncheon at which Mr. John Marsh, I.W.S. director, who will have just returned from a six-week tour of North America, will talk on "Impressions of Management Thinking in the U.S.A." The course will finish with an open forum on personnel practice.

Technical Writers' Directory

A NEW annual register of technical writers, translators, abstracters, specialist copywriters etc. in British industry, is to be published shortly. The publication will list essential personal and professional data.

Interested readers are invited to apply early for forms. Free listing in The Annuary of British Technical Writers and Translators is offered, and it is hoped that the collation of a national list will stimulate the development of a professional association. Enquiries should be sent to: The Editor, Annuary Section, Euro-Teknika, 12, St. George's Road, London, N.W.11.

COMMERCIAL EDUCATION REVIEW

Importance of More Concentrated Training

THAT a greater national effort is needed in education and training for commerce is the keynote of a unanimous report by the advisory committee on further education for commerce published last month by H.M.S.O. price 2 6d. In a foreword the Right Hon. Geoffrey Lloyd, Minister of Education, says that he is reviewing the report and hopes to announce the Government's decisions shortly.

The committee emphasises the increasing intensity of the competition from overseas. "More and more countries are building up their industries and offering for sale goods once considered typically British. Many of this country's European competitors have developed elaborate systems of commercial education and are making intensive efforts to strengthen them." The committee are particularly impressed by

the "high schools of commerce" on the Continent which offer full-time university-level courses of at least three years combining "much of the academic work conducted by the faculties of economics at the universities in this country with the more practical study of commercial knowledge and techniques."

Included among the committee's thirty recommendations are proposals for the introduction of advanced sandwich courses in commercial subjects, on the lines of those already established in the field of technology, and the creation of a new national award for students in colleges and departments of commerce who have successfully taken advanced sandwich courses to degree level.

The present "excessive reliance" on evening study is particularly criticised. The report recommends the much wider adoption of com-



ELECTRICAL EXHIBITION WAS A RECORD

A RECORD number of home and overseas visitors attended this year's Electrical Engineers Exhibition that took place at Earls Court from March 17-21.

The total attendance for the five days was 68,249, including 639 overseas visitors from 71 countries against 600 visitors from 60 countries last year.

Exhibitors report excellent business and a number of important enquiries including one for £1-million. One firm received an order for an £18,000 night security system. Three enquiries were received for giant clocks such as the 60 ft. dia. show piece that dominated the Exhibition. An American source has also asked for details of the clock, priced at about £11,500.

The firm who made the clock (Synchronome Ltd.), also completed the sale of a carillone (electronic chimes) at the Show. It will be installed in O'Connell Street at the premises of one of the largest jewellers in Dublin. The chimes—equal to 10 tons of bells—will be heard over a 2 mile radius in the centre of the city.

mercial apprenticeship schemes and a 250 per cent increase "by 1964 at the latest" in the number of students released for part-time day courses. Also recommended are special courses in salesmanship and marketing, foreign languages and foreign business conditions, and short refresher and conversion courses on modern business techniques. Much greater support is urged for courses in retail distribution.

The chairman of the advisory committee set up following a request by Viscount Hailsham, Minister of Education at that time, is Mr. J. G. McMeeking, C.B.E., F.B.I.M., J.P. Mr. McMeeking is managing director of A. C. Gill Ltd., of Nottingham, chairman of the education committee of the Association of British Chambers of Commerce, and vice-chairman of the regional advisory council for further education in the East Midlands.



Midland's I.V.E. Annual Meeting

THE Midland Section of the Institute of Vitreous Enamellers held its annual general meeting on January 30 at the Station Hotel, Dudley, with Mr. Bernstein in the chair and 78 other members present. After the minutes of the last annual general meeting had been read the following were duly proposed and recorded to serve on the 1959-60 committee of five, to which Mr. Bernstein as the retiring chairman was automatically co-opted: Mr. Darrall Baldwin, Mr. A. Biddulph, Mr. W. A. Ball, Mr. K. Phipps and Mr. G. Legg. Mr. D. Sleath was re-elected section honorary secretary, and Mr. P. Gilbert section lanternist.

The new committee will meet shortly to elect a new chairman, who will take office at the full annual general meeting of the Institute.

TRADE and TECHNICAL PUBLICATIONS

"Metco News" Vol. 8, No. 12 issue of the bi-monthly house journal published by Metallizing Engineering Co. Inc., Westbury, L.I., N.Y., U.S.A., whose British agents are Metallizing Equipment Co. Ltd., Chobam, nr. Woking, Surrey, describes an interesting application of the metallizing process used instead of painting for the protection of exposed pipework. The company concerned is the Natural Gas Pipeline Co. of America, one of six companies operating under a single management to transmit natural gas through high pressure pipelines from production plant in the Texas Panhandle into the Chicago area. At the Fritch station in Texas, the manifold piping laid above ground has been protected from corrosion by metallizing. Until 1949, the company painted the various exposed components subject to a corrosion caused mainly by spray from the cooling towers. Some parts of the equipment reached a temperature of 350 F., and the combination of heat and accelerated corrosion caused paint to deteriorate in less than two years. The original metallized coating, applied nine years ago, is still in good condition, the company says.

"Omicron" Publication No. B5805 published by Air Control Installations Ltd., Ruislip, Mddx., is a leaflet describing the dry-type replaceable air filter made by the company. The unit is compact, easily installed and replaced, and disposable by incineration if desired, a facility particularly valuable when radioactive dusts are handled. It will function without loss of efficiency in most climatic conditions, including high humidity, the company says. One of its many uses is the filtration of toxic fumes.

Bulletin 873, issued by the same company, describes the air filter gauges made by the American Air Filter Co., Inc., Louisville, U.S.A.

Tin Research Appt.



Dr. Dudley Robins

Pins for U.S. Frit Makers



SEEN in the picture above are two "veterans" of the ceramics industry in the United States, Mr. H. R. Urbach (left) treasurer and general manager of the O. Hommel Co., Pittsburgh, and the company's president, Mr. Ernest M. Hommel. Both were attending the service pin award ceremony held annually by the Pittsburgh firm. Mr. Urbach's pin represented fifty five year's service. He was the fifth man on the payroll when he joined in 1903, and has seen the whole of the company's subsequent development, culminating in the opening of a new research centre at the end of last year.

THE International Tin Research Council has announced the appointment of Dr. Dudley A. Robins, Ph.D., A.I.M., A.Inst.P., as chief metallurgist at the Tin Research Institute Greenford, in succession to Dr. E. C. Ellwood, B.Sc., Ph. D., F.I.M., M.I.M.M., who has been appointed to the chair of metallurgy at the Royal College of Science and Technology, Glasgow.

Dr. Robins, who took up his post with the Tin Research Institute on April 1, is senior metallurgist at the General Electric Co.'s research laboratories at North Wembley.

Dr. Ellwood joined the Tin Research Institute in 1952 from King's College, University of Durham, where he was lecturer in Metallurgy, and is the third senior officer from the Tin Research Institute to be appointed to a University chair of metallurgy.

Latest Developments

in

PLANT, PROCESSES AND EQUIPMENT

Attachment Cleans Parts Bins

A BIN tool (Fig. 1) for use in removing dirt and dust from nuts, bolts, washers, screws, etc., has been produced by Martindale Electric Co. Ltd., Westmorland Road, London, N.W.9. This latest addition to the company's standard range of suction attachments should be welcomed by many industries.

The tool can be connected by a suction attachment hose to any type of standard Martindale portable industrial blower. When the blower is switched on the tool is held over the container, the parts to be cleaned are drawn up into the nose chamber and then agitated to remove any dust and other dirt that may have collected. A mesh screen fitted in the top of the nose chamber ensures that no small washers or nuts are sucked through into the power unit. A spring-loaded operating lever at the top of the handle can be depressed by the operator's thumb. The tool is light and durable, the nose chamber is made of polished aluminium, and the handle is finished in mottle grey. It can be used in conjunction with the Martindale "port-a-vac" harness which enables a blower and dustbag to be carried on the operator's back.

Improved Rigid Foam Component

A RIGID polyurethane foam, Daltolac 24, for heat and sound insulation in building and general engineering, and for shock absorption and buoyancy in shipbuilding and other fields, has recently been introduced by I.C.I. Dyestuffs Division, who point out that it extends the range of densities which can be achieved by foaming *in situ* techniques using the two-component polyurethane foam systems, the organic isocyanate Suprasec D being the other component in each case.

Daltolac 24 contains not only the requisite amount of fireproofing agent, as incorporated in



Fig. 1.—This suction attachment for a standard industrial blower has been designed to clean spare-parts bins.

the earlier Daltolac 22, but a reaction catalyst and other additives so that when 100 parts are reacted with 130 parts of Suprasec D, fine-textured rigid foams with densities between 1.8 and 2 lb. per cu. ft. are obtained.

The catalysts hitherto available for polyurethane foams have not only had an obnoxious smell, which made them unsuitable for use in badly ventilated spaces, but they so increased the foaming rate that it was difficult, if not impossible, to place the foam mix into cavities before foaming commenced.

The catalyst used in Daltolac 24 has little or no odour and allows an adequate time for mixing and pouring of the foam mix.

The foams produced are competitive in cost with most conventional insulating materials, and have in addition the now well-established advantages of rigid polyurethane foams, including firm adhesion to surfaces of all kinds, ability to fill cavities of all shapes completely (so eliminating one source of heat loss in heat-insulation applications), avoidance of the transport of bulky pre-formed blocks, and of course, their generally much lighter weight.



Fig. 2.—This recorder measures elapsed time between maintenance periods.

Improved Elapsed Time Indicator

AS is well known, the elapsed-time indicator is an instrument that registers the true operating hours of a vehicle or machine, information that is invaluable when assessing maintenance requirements. In addition, knowledge of the load or utilization factor of production equipment of all kinds is essential for planning the most effective methods of daily operation. Cass and Phillip Ltd., Mark Road, Adeyfield, Hemel Hempstead, Herts., have recently introduced a completely sealed, insulated and waterproof unit designed with a double-skin case, the mechanism being mounted internally on beryllium copper-leaf springs (Fig. 2). The balance staff, balance wheel and armature assembly are jewel mounted, to give a robust construction.

Four leaf springs, spaced 90 deg. apart, carry the complete mechanism, which is then inserted in a polythene case, the springs being located in grooves moulded in the case. This assembly is then installed in a steel outer case, and electrical contact is made through insulated terminals in the rear.

The dial glass is located in a recess of the polythene case, and a specially contoured rubber sealing ring, maintained in position by the bezel, completes the sealing. Apart from being completely sealed against ingress of water and dust, the instrument movement is electrically insulated from the case and, therefore, the case does not provide a connection to earth as on earlier models.

Elapsed time can easily be read in hours and minutes to the nearest 15 seconds, and timing accuracy is better than 15 seconds in 24 hours.

As a result of these and other modifications in design, the indicator can be used under very adverse conditions of humidity and vibration, the

makers say, and it is also eminently suitable for use in electrical circuits where earthing of the case is a disadvantage.

Lagging for Drying Ovens

ALTHOUGH not new, a preformed semi-rigid slab form of "Stillite" S.R.10 manufactured by Stillite Products Ltd., 15 Whitehall, London, S.W.1, is being increasingly used in industry for its thermal and acoustic applications. One such application is in the lagging of industrial drying ovens where its use can effect considerable economy in heating costs.

The slabs are manufactured by an automatic process involving the compression and stabilisation of long Stillite mineral wool fibres. The consistency obtained is such that the material is easy to handle, readily accommodates surface irregularities and can be cut easily to any shape or size. The firm says that because of the low "shot" content a very high efficiency for a given density is obtained. The slabs are fireproof, having a melting point in excess of 2500°F., odourless and free from irritants. The material cannot cause corrosion. The slabs are recommended for use at temperatures up to 750°F. Above this point, greater thermal efficiency can be obtained by using another form of the material, "Therbloc," details of which can be obtained from the company on request.

The slabs are made in a range of standard sizes in thicknesses from 1-in. to 4-in. rising by $\frac{1}{2}$ -in. stages.

Protective Clothing

A comprehensive range of protective clothing for both factory and outdoor workers is now being marketed by the protective clothing division of Scaffolding (Great Britain) Ltd., Willow Lane, Mitcham, Surrey. In the range are boiler suits, overalls, gloves, aprons, safety footwear, helmets and goggles, and a variety of outdoor clothing. Distribution is made from stocks held at the company's 36 branches throughout the country. Full particulars are contained in a recently-issued booklet obtainable free from the company on application.

Silicones in Improved Aerosol Pack

THE well-known characteristics of silicones—freedom from sticking, resistance to extremes of temperature, outstanding water repellency, excellent electrical insulating properties, and good chemical and physical stability—have made silicones invaluable in many applications. Solvolene Lubricants Ltd., Reginald Square, London, S.E.8, are now producing an aerosol containing pure silicone at what they believe to be a very competitive

price when compared with other forms of packing. The company claim that by using a new type of valve, a larger container and less propellant, considerable savings in production costs have been made, so that their 16-oz. "Solvosil" is now a very reasonable proposition for those users who have formerly rejected the aerosol pack as being too costly.

Rectifier Permits Reverse Current Etch

A METHOD of combining different semiconductor elements has led to the development of a rectifier to permit reverse current etch prior to chromium plating, in high amperage ratings.

The Sel-Rex Corp., Nutley, New Jersey, who have recently introduced the rectifier, state that the polarity reversal on units up to 10,000 amperes is obtainable by a panel mounted switch, or a push-button operated pneumatic device.

Among the advantages claimed for the new rectifiers, as compared to equipment previously required for the application, are: lower initial expenditures and installation costs and static operation eliminating moving parts.

British agents for Sel-Rex are M. L. Alkan Ltd., South Ruislip, Middx.

Mercuryless Instrument

IN addition to their "Commander" range, the new Kent-Barton mercuryless diaphragm instrument for the measurement of differential pressures in six maximum ranges, and up to 2500 lb./sq. in. working pressure, was announced recently by George Kent Ltd., Luton, Beds.

The instruments (Fig. 3) available intrinsically as circular-chart recorders, sector-scale indicators and circular-scale indicators, incorporate the "Barton" patented rupture-proof differential unit. Although employing sensitive bellows for its actuating element, the unit can be subjected to pressure differences equivalent to the pressure rating of the instrument without damage, and full line pressure can be applied across the bellows unit in either direction without damage—irrespective of the differential-pressure range of the instrument—it is claimed.

The torque-tube drive for conveying bellows movement to the instrument-index mechanism is leakage-free and requires no periodic lubrication, being virtually frictionless for the life of the instrument. Only the bellows exteriors are exposed to the metered fluid, and the unit is therefore completely self-draining or venting, is without pockets to trap condensates and sediment formations, and has no small tubes or other restrictions to interfere with its function.

To these recorders and indicators for flow, level, specific gravity etc., can be added—with certain



Fig. 3.—A mercury-less diaphragm instrument for the measurement of differential pressures.

limitations—additional measuring elements for pressure (Bourdon tube) and/or temperature (mercury-in-steel); also air-operated automatic control or transmission of the primary variable by incorporation of one of the new Kent "Mark 30" series of units. Other optional instrument functions are integration of rate of flow and, for recorders, crescent-scale indication. All Kent-Barton instruments in the "Commander" range enjoy standardization of parts and interchangeable-unit construction, greatly simplifying service and maintenance problems and reducing the number of spares carried. B.S. have been followed throughout.

Improved Etch Primer

WHAT is claimed to be a much improved etch primer was introduced recently by Federated Paints Ltd., Dobbies Loan, Glasgow.

A new version of the original "Strathclyde" etching primer, the makers say it has now absolute stability and indefinite can life. Called etching primer PA-10, it is capable of uninterrupted application by spray-gun, essential in automation. It is equally effective applied by brush, spray or by dipping and by any of these methods air-dries in 30 minutes. It can be stoved for quicker drying if necessary. Adhesion on mild steel, or on cadmium plate, is claimed to be more than double that of a good quality metal priming paint. The manufacturers are making available free sample tins so that anyone interested can carry out a practical test.

Metal Finishing Conference

(Continued from page 145)

D. E. J. Cunningham's contribution on "**Recent Advances in Plastic Coating for Metals**" was available at the Conference only in summary form. The complete paper will describe current practice in applying plastic coatings by powder spraying and dipping, flame spraying, and solution or dispersion methods, and will include accounts of equipment, pre-treatment processes and test methods. Details will be given of the characteristic properties of the plastics in common use as coatings for steel.

The formulation of paints and lacquers, etc. for industrial use is very largely in the hands of the paint manufacturers. In the selection of the best materials for a particular application, paint users are, with some exceptions, probably more dependent on their suppliers than the users of any other metal finishing process. There are good reasons why this should be so. Nevertheless, while it is no doubt fortunate that a satisfactory painting job can usually be achieved with little or no knowledge of the constituents of the paint, anyone hoping to

obtain the best possible finish for his products, at reasonable cost, should at least appreciate the range of materials available, and know something of their properties. So far as synthetic chemicals are concerned, R. L. Yeates in his paper entitled "**The Impact of Organic Chemistry on Metal Finishing**" provides in readable form the basic information required by the non-specialist.

Materials derived from natural products are not altogether excluded, and the paper deals with cellulose nitrate and acetate as well as with resins of the following types: phenolic, alkyd, amino, epoxy, vinyl, styrenated, acrylic, polyurethane, polyester and silicone. Solvents and plasticizers are also taken into account. For each product, a brief description is given of the process of production and its historical development; the characteristics of organic finishes employing the particular material are described, with reference to ease of application, chemical and physical properties of the film, and cost. Typical applications are mentioned. The characteristic properties of the resins, used singly and in combination with other resins, are summarized diagrammatically at the end of the paper.

"Plating Automatically"

ON March 10 a capacity audience were present to view the premier showing of the Efco-Udylite film "Plating Automatically." This showing took place at the British Council Film Theatre and the response to the invitation to be present extended by Electro-Chemical Engineering Co. Ltd. had been so great that it exceeded the capacity of the theatre and made two showings necessary.

The film, in full colour, traced the emergence of automatic plating from the older manual method and described in some detail the operation of the Efco-Udylite system. A number of interesting installations were also featured.

Two other films, one of which featured a recent important automatic installation at the Fiat works in Milan, were shown in support of the new film, which can be made available for showing to other audiences on application.

Sixth International Galvanizing Conference

PROVISIONAL arrangements are now being made for the Sixth International Conference on hot-dip galvanizing which is to be held in Cannes, France, in May 1961. The Conference will be organized by the European General Galvanizers' Association; detailed arrangements in France will be made by its member, the Association Technique Francaise de Galvanisation.

Subjects for discussion at the Conference will

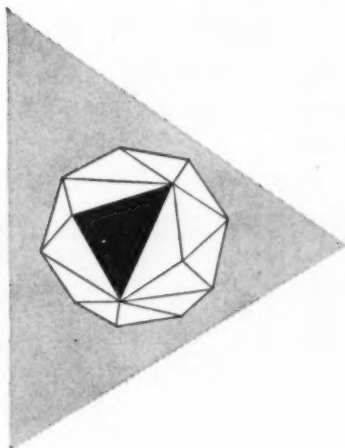
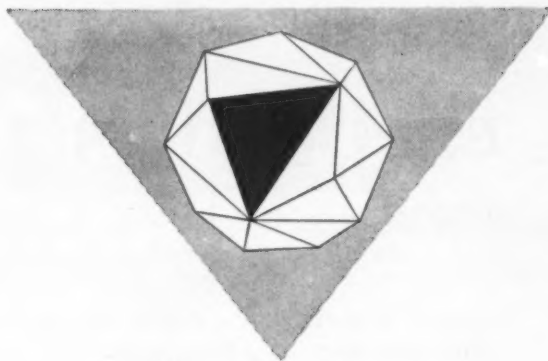
include some or all of those mentioned below and persons interested in submitting original papers for presentation at the Conference are asked to communicate with the organizers. Papers are required on: Work practice in general galvanizing; Bath heating and control; Galvanizing equipment; Pretreatment of steel for galvanizing; Metallurgy of galvanizing; Influence of steel and bath composition; After treatments of galvanized steel; The treatment of residues; Corrosion of galvanized coatings; Quality control in galvanizing; Sheet, wire and tube galvanizing.

For further information, please write to the Zinc Development Association, secretary to the E.G.G.A., 34, Berkeley Square, London, W.1.

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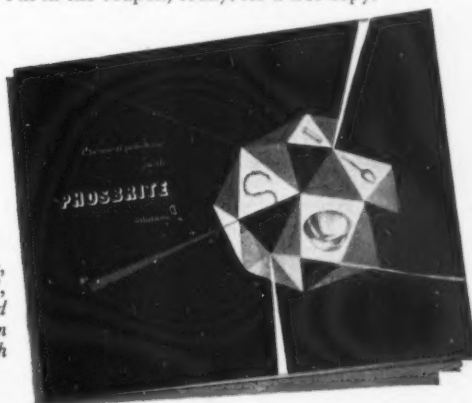
(Concluded from page 155)

used for out-of-round work such as automobile trim, ventilator surrounds and general automobile mouldings. The work is mounted on a sprocket-driven fixture and the work-table rotates, maintaining a constant point of contact of the work in relation to the wheel. This machine can either be controlled manually or fitted with an air lift and time control for automatic cycle operation. This unit may also be furnished with an individual adjustable floating head and a separate fabricated table to handle larger type of mouldings, not suitable for a standard machine.



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